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WISCONSIN

State Horticultural Society

BULLETIN No. 1

The Planting of Trees and Shrubs

MADISON, WIS., MARCH, 1903

☞The Bulletins and Annual Reports of this Society are sent free to members of the Society

Wisconsin State Horticultural Society

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Introduction.

One of the purposes of the Wisconsin State Horticultural Society as stated in its articles of incorporation is to "promote the horticultural interests of the state by the collection and dissemination of information in regard to the cultivation of fruits, flowers and trees adapted to our soil and climate, and in every proper way to advance the fruit and tree growing interests of the state."

This has been accomplished in the past mainly through the Annual Report supplemented from 1896 to 1902 by the Wisconsin Horticulturist a monthly magazine since discontinued. Many of the members feeling that the Society should have some regular means of reaching those searching for information have suggested the Bulletin. Acting on this suggestion the Executive Committee has authorized the publication of this the first Bulletin issued by the Society. It is not claimed by the author that it contains a single new fact, but aims only to describe in simple terms the necessary points to be observed in properly planting a tree or shrub. Upon the nature of its reception by its readers will depend in a large measure the publication of other numbers.

The Planting of Trees and Shrubs.

F. CRANEFIELD.

Many thousands of trees and plants are set out every year in this state; some live, many die.

In some cases the nurseryman is at fault. He may send out dead or weakened stock. Sometimes the railroads delay shipments until the trees are injured beyond recovery. More often the planter is at fault. The trees may arrive in good condition but in the rush of spring work the bundle is laid aside until a convenient time arrives to plant, or the trees may be improperly planted.

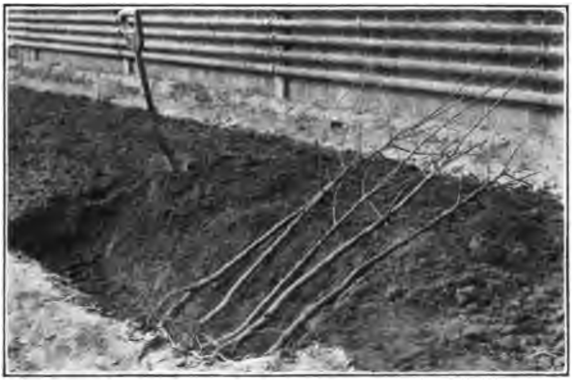

FIG. 1. Showing method of "heeling-in" trees when planting is delayed.

Trees and plants in small lots are packed in bundles at the nursery. If the work is well done the roots should be packed in damp moss or excelsior and this covered with burlap. The tops should also be completely covered either with rye straw or burlap. This packing is usually sufficient to protect the plants from drying until they have arrived at their destination, but is not intended to preserve them longer.

Never under any circumstances leave the trees in the shipping package, even over night. If possible plant at once, otherwise open the bundle and "heel-in" the trees or plants.

"Heeling-in" is temporary planting. To do this dig a trench wide and deep enough to accommodate the roots with one side sloping as shown in Fig. 1.

Open the bundle, lay the trees separately in the trench with tops resting on sloping bank. Cover the roots with moist earth sifting it well among the roots. Tramp firmly and when the trench is filled cover again with one inch of loose earth. The heeling-in spot should be on well drained ground. Treated in this manner trees may remain for several days or even weeks if in a shaded and cool place. The same applies to bushes and even strawberry plants. If trees are shrivelled when received bend down the tops after heeling-in and cover them with moist earth. Often in two or three days they will be found to be plump and fresh.

HINTS ON PLANTING.

The ground should be deeply plowed and well cultivated before planting. Do not set out a young orchard in sod. The grass roots will reach out and rob the trees of food and water. If you cannot devote a piece of land to trees alone and keep it in cultivation, do not attempt fruit growing as the results will be disappointing.

Dig holes large enough to accommodate the roots after these have been cut back to sound wood. Fit the holes to the roots, not the roots to the holes. Trim broken and crushed roots back to sound wood. Do not cut off more. The tree was deprived of about seven-tenths of its roots when dug. It will need all that remains. Don't worry about the fine, fibrous roots about which so much has been written,—these are dead anyway if the tree has been out of the ground more than an hour, —take care of the larger rooots for it is from these that growth starts.

Protect the roots from the sun and wind every moment from the time the bundle is opened until the tree is set. When in the field planting throw a wet burlap or grain sack over the roots.

The hole should be deep enough to admit setting the tree about two inches deeper than it stood in the nursery. Get down on your knees: It is difficult if not impossible to plant a tree while standing upright. Spread out the roots and sift fine earth about the roots and pack firmly, at first with the fingers and when the roots are out of sight get up and tramp firmly with the feet. If the earth is moist and mellow, it cannot be tramped too firmly. It must be in close contact with the roots in order to enable them to take up the water it contains.

PRUNING.

The tree is now safely anchored in the ground but the work is not finished. At this point arises a very common cause of failure. Some of the branches must be removed or the tree is apt to perish.

Before removal from the nursery the tree had sufficient roots to supply all of its buds with water. In digging, most of the roots have been (necessarily) removed, but the buds are left. When growth begins every healthy bud will push out and call on the roots for water to feed its new-born leaves. The very limited supply that the reduced root system can pump up will be distributed equally and as a result none may have enough to develop its leaves and without leaves the tree must perish. We must, therefore, reduce the number of these water pumps by removing one-fourth to one-half the buds. An illustration of the method of doing it is shown in Fig. 2.

The drier the ground and the weather the more we should cut off.

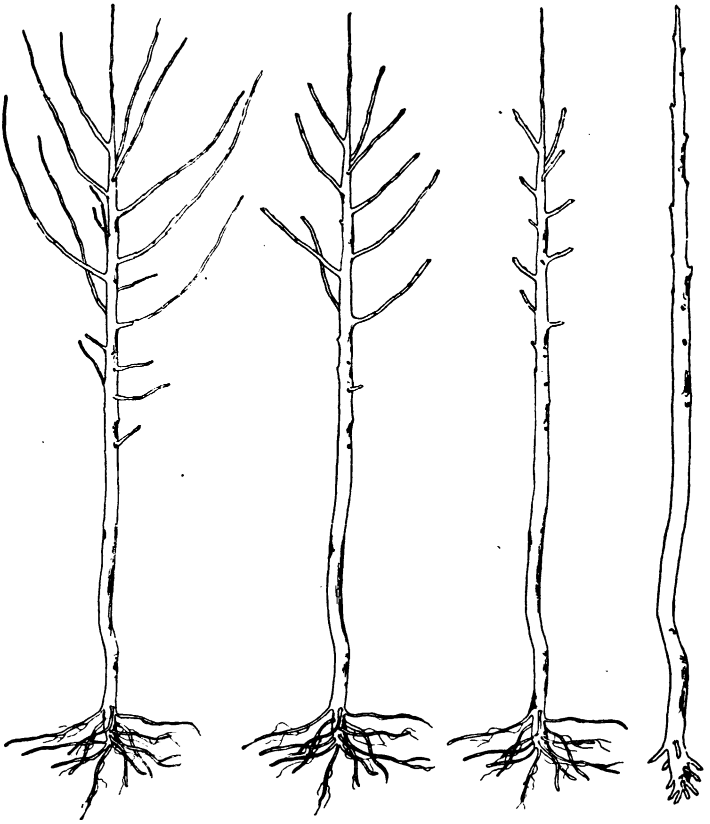

FIG. 2. Showing methods of cutting back trees at planting time. Beginning at left: No. 1, unpruned; No. 2, pruned sufficiently if the tree is well planted in moist ground; No. 3, showing extent of pruning necessary for weakened trees and trees set in dry weather. No. 4, Stringfellow method: (See p. 9.)

The manner in which the cutting is done will depend to a great extent upon the kind of tree or bush. In apples, plums, etc., we need to bear in mind the ultimate shape of the tree. The framework upon which the branch system is built is determined largely at this time. Remove crowding, crossing, and interfering branches. Aim to leave the main branches spirally about the stem rather than opposite. The lower opposite branches in fruit trees form bad forks that may split down later.

MULCHING.

The work is still unfinished unless the tree is mulched. This mulching may be done with the hoe or cultivator, stirring the soil frequently.

Another way is to put plenty of strawy manure or straw about the tree. Trees may be well planted and yet die if not mulched. It is a good plan to protect the trunk from sun and wind. Six different tree protectors are shown in Fig. 3. A choice should not be difficult.

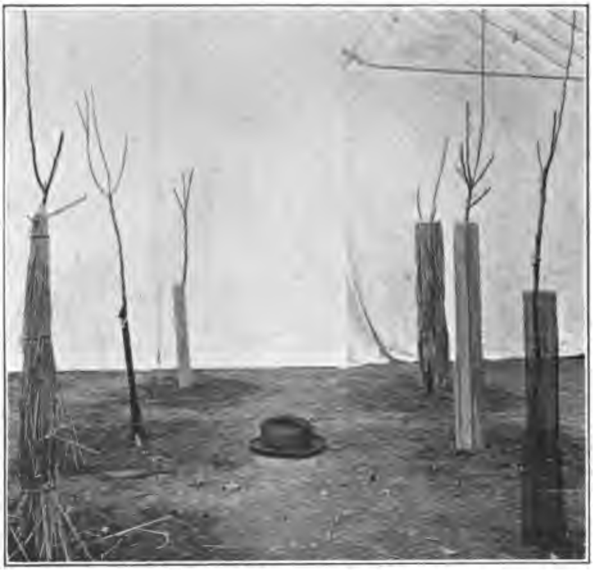

FIG. 3. Showing six different methods of protecting tree trunks, viz.: Wire netting, lath, corn stalks, rye straw, black-enamel paper and veneer. If paper is used it should be renewed spring and autumn, the others may remain throughout the year.

In the case of shade trees and sometimes in re-planting in old orchards it is necessary to set in sod. In this case the sod should be removed over a circle not less than six feet in diameter and after the tree is set a heavy mulch applied, or better, a thorough hoeing given once a week. The principles here cited for trees apply equally well to smaller plants. The following from Bull. 105 Wis. Exp. Sta. relates to planting ornamental shrubs.

*"Even if the plan is definite and correct there may yet be failure if the shrubs are not properly set. Many people, notably farmers who have a practical knowledge of the needs of plants and the requirements for their best development, seem to utterly ignore these needs in lawn planting. A small patch of sod is removed, the plant set and often the sods carefully replaced about the stem. The struggle at once begins between the bush and the multitude of established grass roots. The result may be easily predicted: the shrub is starved. Imagine a hill of corn with such treatment!

We cannot expect, nor should we wish for grass and shrubs on the same area. The sod should be removed from about the roots and the soil kept cultivated or mulched. In planting groups or masses the whole area should be spaded before setting the bushes and afterwards cultivated until the plants completely shade the ground.

The distance apart to set shrubs in groups will depend upon the size of the plants at maturity. They should be close enough to present a continuous line of verdure. The individuality of each, at maturity, should be completely merged in the mass with the exception, perhaps, of a plant here and there on the border which may stand out alone. The majority of shrubs may be safely planted three to four feet apart in this climate."

ABOUT WATERING OUT TREES AND PLANTS.

If trees are set in the proper season, viz., very early in spring, it is rarely necessary to apply water at planting time. At this time there is usually an abundance of moisture to start the tree if this moisture is preserved by cultivation or mulching. If trees must be watered out there is but one right way to do it, that is, by watering before the tree is planted, either by pouring a pail of water in the hole immediately before setting the tree or when the hole is half filled with earth. The latter plan is probably the better as the water will compact the earth about the roots. In this case the filling may be delayed for a time until other trees are set, to allow the surplus water to escape. Pouring water on the surface after the tree is set is useless and may even be harmful. The water rarely reaches the roots and only moistens the surface. The roots are attracted to this moist zone thus growing upward instead of downward only to perish when drought comes later.

THE STRINGFELLOW METHOD.

Mr. H. M. Stringfellow, a well known horticulturist of Galveston, Texas, advocates a method of pruning nursery grown trees when

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*Bulletin No. 105, Wis. Agr. Exp. Sta.

setting that is a radical departure from the common method described above. It consists, in brief, of removing all fine roots and cutting back the larger ones to mere stubs as shown in Fig. 1. All branches are also removed. The trees are then set with a crow-bar, dibble, or in a narrow opening made by thrusting a spade into the ground.

Peach trees planted in this manner, in the South, appear to thrive, but in Northern latitudes it has not proven successful. It is yet a subject for experiment in Wisconsin and should not be practiced except on a small scale until its merits are proven.

The following hints regarding soil, site, etc., for the common fruits may be helpful to the amateur.

APPLES.

Soil: Clayey loam with permeable clay subsoil.

Site: Elevated—north slope preferable.

Distance Apart to Set Trees: 20 to 24 feet.

Age of Trees to Set: Two year old trees preferable.

Culture: Cultivate until July 15th or August 1st, then sow cover crop, oats or hairy vetch. Plow same under in the spring.

Protection: Spray with Bordeaux mixture and Paris Green before leaves appear and after blossoms have fallen, and again when the fruit is one-third grown. Protect trunks with veneer wrappers. Keep ground clean; rubbish harbors borers.

Pruning: In March cut out interferring branches—keep center of tree open. Head tree low when planting—18 to 24 inches.

PLUMS. (Native)

Soil: Any well drained land. Native plums are adapted to a wider range of soil than other tree fruits. Many varieties thrive on sandy soil.

Site: Same as for apples.

Distance: 18 to 20 feet.

Age of Trees: 2 to 3 years.

Culture: Same as for apples.

Protection: Same as for apples. In addition jar for curculio and gouger.

Pruning: Cut back annually, in spring, the strongest shoots. Plums require less pruning than apples.

CHERRIES.

Soil: Light, well drained soil. Cherries will not thrive on heavy, moist land.

Distance: 20 feet.

Age of Trees: 2 to 3 years old.

Culture: Same as for plums.

BLACKBERRIES AND RASPBERRIES.

Soil: Light loam with clay subsoil. The bramble fruits thrive best when the roots may penetrate a cool subsoil.

Site: Level ground.

Distance: 4 x 8 feet.

Culture: Shallow cultivation throughout season. After first year provide post and wire trellis about two feet in height. Some low growing varieties do not require support. Most varieties require winter protection. Bend the plants to the ground and cover with one to two inches of earth.

Pruning: Remove and burn all the fruiting canes as soon as crop is picked. Leave but five to six new shoots for succeeding crop.

GRAPES.

Soil: Any well drained soil. Thrive somewhat better on light loam or sandy soil.

Site: South slope preferred, to afford air drainage and sunlight.

Distance: 8 x 8 feet.

Age of Plants: 2 years.

Culture: Clean culture: provide six-foot post and wire trellis for support of vines after the first year. Prune vines in October and protect by covering with earth.

Protection: Spray with Bordeaux once before leaves appear and again when leaves are fully expanded.

Theory of Pruning: "Fruit is borne on wood of the present season, which arises from wood of the previous season." Renew bearing canes every three or four years.

STRAWBERRIES.

Soil: Any well enriched and well drained land. (Good corn land.)

Site: Immaterial.

Distance: 2 x 4 feet.

Plants: Only new runner plants (current season's growth) should be used.

Culture: Plant in spring: use only rotted manure for enriching land. Fall plowing preferable. Keep plantation free from weeds and grass. Confine plants to rows not more than 18 inches wide by cutting off runners. Cover plants lightly with marsh hay in November for winter protection. Do not fruit a plantation more than two years. To keep the rust in check spray with Bordeaux mixture once before the blossoms open and again after the fruit is set.

CURRANTS AND GOOSEBERRIES.

Soil: Well enriched, moist land.

Site: Immaterial.

Distance: 4 x 4 feet.

Age of Plants: 2 years.

Culture: Cultivate thoroughly throughout the season. A heavy mulch of coal ashes may be applied about the roots to advantage.

Protection: Spray with Bordeaux in June to prevent fungus which causes premature dropping of leaves. Spray frequently with white hellebore (1 oz. to 3 gal. of water) as worms appear.

Pruning: Remove one-quarter to one-third of oldest canes each year.

WISCONSIN

State Horticultural Society

BULLETIN No. 2

Published by authority of the Executive Committee

Strawberries for the Home Garden

MADISON, WIS., APRIL, 1904

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free to members of the Society

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The Wisconsin State Horticultural Society.

PAST: Fifty-one years of profitable work.

PRESENT: (1) More interest manifested than ever before; (2) Four trial orchards established and maintained by the Society in Northern Wisconsin carrying fruit growing up to Lake Superior; (3) Valuable work in other fields.

FUTURE: Very promising. Limited only by the enthusiasm of its members, and that is unlimited.

MEMBERSHIP: Membership is not limited to professional cultivators. Every one who has a fruit tree, a berry bush, a flowering plant or even a hill of beans, is eligible. Even if you have none of these, join anyway, and learn how to cultivate at least one of them. The annual membership fee of $1 may be sent to the Secretary at Madison.

HISTORY.

In 1853 a band of enthusiastic fruit growers met at Whitewater and organized the Wisconsin Fruit Growers' Association. This society held successful annual exhibitions until 1862.

In 1865 the Association met and re-organized, taking the name of The **Wisconsin State Horticultural Society.**

From that year until the present the Society has held annual or semi-annual meetings, given exhibitions and through its members and printed reports preached the gospel of fruits and flowers.

Like other industries fruit growing in Wisconsin has had its ups and downs. The early reports of the W. F. G. A. show that these pioneers had planted all manner of fruits, even quinces. Later, in the early seventies, the fierce Wisconsin winters swept away all the tender fruits and discouragement fell on all but a few of the faithful. The stout-hearted ones said. "If we cannot grow the Pippin and the Bellefleuer we will produce varieties that will grow," and they set about doing it. For twenty-five years members of the Wisconsin State Horticultural Society have been prying into the secret of nature and battling with the elements to find fruits fitted to Wisconsin conditions. The records of the work done by the members of the Society may be found in every part of the state.

The records of the Society are also written for all time in gold, silver and bronze, for at all great Expositions, including Chicago in 1893, Wisconsin fruit has won medals and unbounded admiration. A host of younger men and women are now rallying to carry on the work and share in the benefits, but their number is too small. The membership roll of our Society should number thousands instead of hundreds. Every man who tills an acre of ground, every woman who wants vegetables, fruits and flowers should be a member of the Society. Every one who reads this is cordially invited to become a member. It costs one dollar a year unless you are already a member of a local society, when fifty cents will be enough. The Annual Report and the Bulletins are sent free to members.

STRAWBERRIES FOR THE HOME GARDEN

F. CRANEFIELD

This little bulletin is intended as a guide for every one who wants strawberries for home use. It is for the home gardener only and not for the commercial grower. Many people, farmers as well as residents in villages and cities, buy strawberries for home use, when in most cases sufficient land is available to produce an abundance of berries. A space 20x50 feet if well tilled may produce annually more strawberries than the average family can consume. Six bushels of strawberries were picked from a patch of this size last year in a private garden in Madison. Every one who has a square rod of tillable ground may have strawberries.

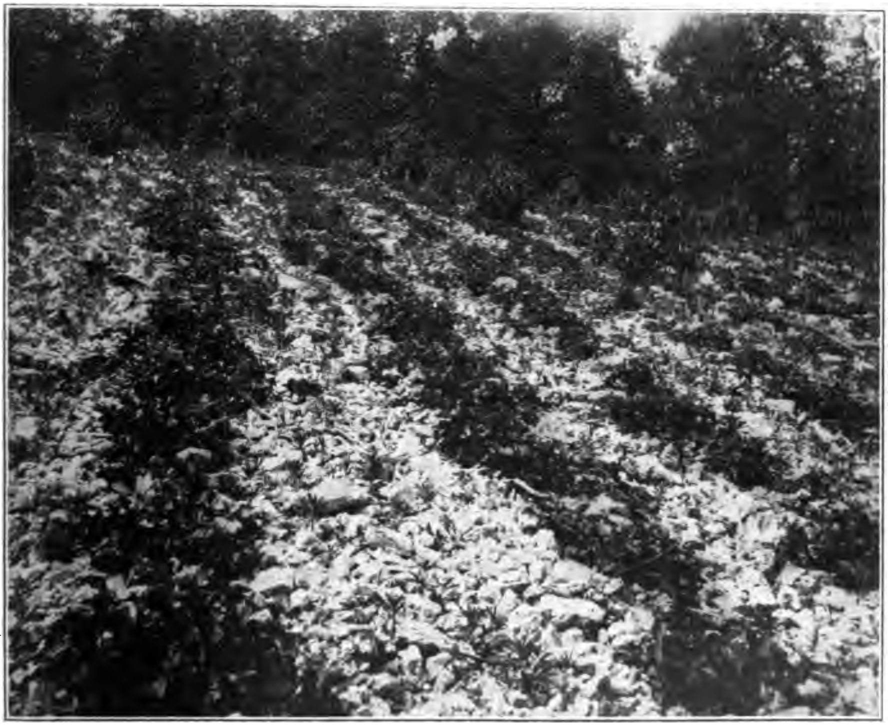

FIG. 1. Showing strawberry plants on very stony land.

Soil.—The character of the soil is of but little importance. Any good garden land will produce strawberries. An extreme case is shown in Fig. 1, where the surface is covered with stones. Fig. 2 shows a sample of the crop obtained on such land.

The soil in the Madison garden mentioned above is stiff clay over swamp muck, which in turn overlays fine sand

Site.—The site is matter of slight importance if not too far from the house. The fruit will ripen earlier and the blossoms suffer less from late spring frosts if located on slightly elevated land sloping gently to east or south.

Soil Preparation.—The ground should be deeply plowed and in every way as well prepared as for corn before planting. On light soils it is a good plan to manure and plow in the fall, as strawberry plants do not start well in very loose and mellow soil. For very heavy soils spring plowing may be preferable.

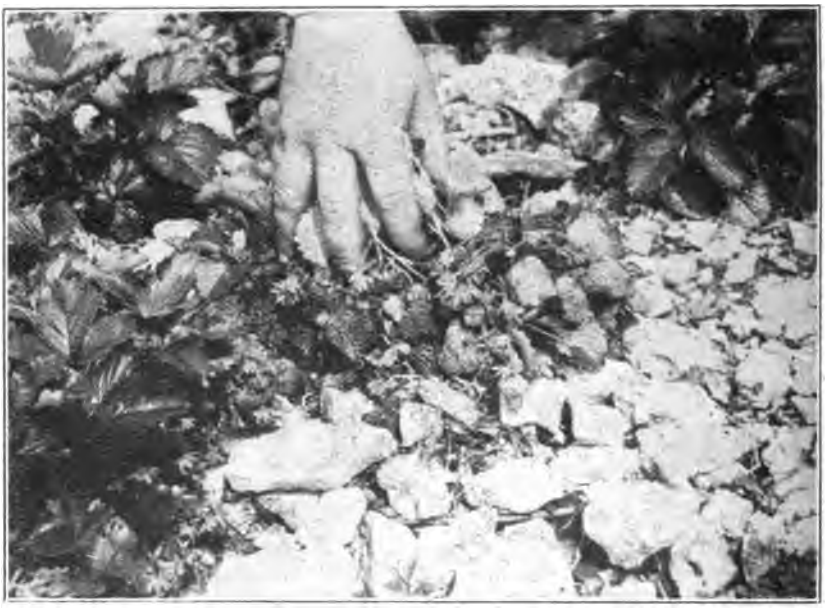

FIG 2. A sample of the crop produced by plants shown in fig 1.

Manure.—Use only thoroughly decayed (unleached) manure. Not only is fresh manure unavailable as plant food but the decaying processes which it undergoes in the soil may cause injury to the roots of the newly set plants if in contact with them.

Best Time for Planting.—Early in spring, as soon as the ground can be worked, is the very best time to plant. Good results, however, may be had by planting later, even at flowering time, if the plants are carefully handled and shaded after planting. Nothing is gained by fall planting for if the plants are allowed to fruit the following spring a poor growth will result that will result in a very scant crop the following year. We should encourage plant making this year that we may have an abundance of fruit next year.

Plants.—Good plants may be had of our Wisconsin nurserymen at reasonable prices. It may also be possible to get thrifty plants from a neighbor, but in this case care must be taken to secure only new plants,—less than one year old. Only young runner plants of the current season's growth that have never borne fruit should be used. These may be known by their light colored roots; plants more than one year old have dark (black) roots.

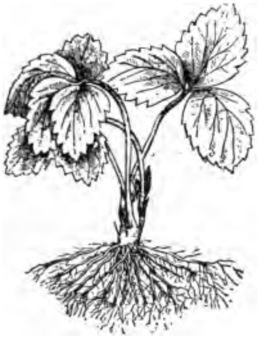

FIG. 3. Showing the branching of roots as a result of root pruning.

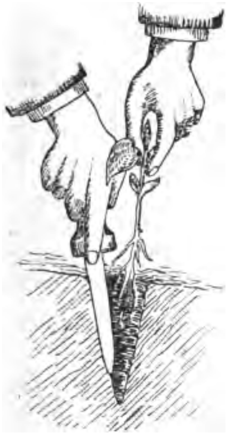

FIG. 4. Showing manner of transplanting with dibber; inserting roots.

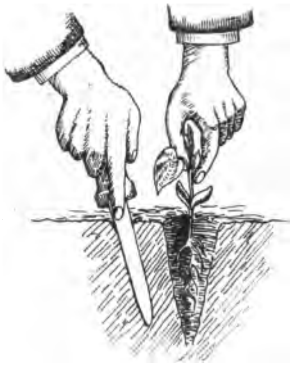

FIG. 5. Pressing earth about roots.

Planting.—For the home garden the plants should be set about two feet apart in rows four feet apart.

The plants should be prepared for planting by removing the old leaves and stems and shortening the roots, both to facilitate planting and encourage branching (Fig. 3). After trimming dip the roots in water and pack snugly in a basket with damp chaff or straw to prevent drying by sun and wind. With a dibber or garden trowel make a narrow and deep opening as shown in Fig. 4, spread the roots fan-shaped and tuck them into this V-shaped opening, close the opening with dibber as shown in Fig. 5 and tramp firmly close to the plant. In this way the roots are down in moist earth. Do not plant by spreading the roots horizontally as shown in Fig. 6, for in this way the roots are all too near the surface.

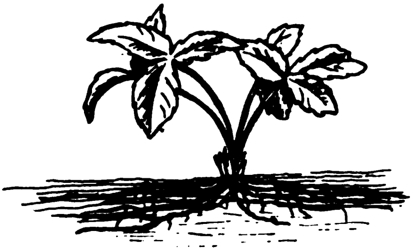

FIG. 6. "Do not plant by spreading the roots horizontally."

Do not set too high with the roots exposed as shown in Fig. 7.

Do not set too deep, as shown in Fig. 8, with the "crown" covered with earth, or the plant will surely die. Fig. 9 shows proper way.

In large plantations the "spade" method is employed. A spade is thrust into the ground and drawn slightly forward. The plant is then placed in the opening behind the spade, the spade withdrawn and the opening closed firmly by again thrusting the spade into the ground close to the roots.

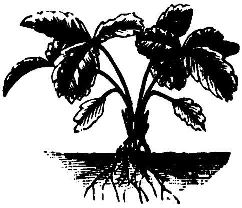

FIG. 7. "Do not set too high with the roots exposed."

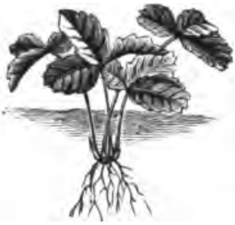

FIG. 8. "Do not set too deep"

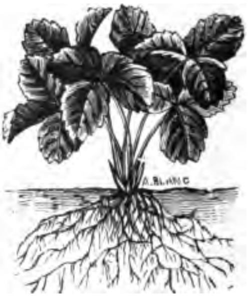

FIG. 9. This is a better plan.

Watering.—If the ground is dry at planting time it may be advisable to apply water. This should be done by pouring it into the hole before the plant is set. Pouring a little water on the surface after the plant is set is apt to do more harm than good. Only the surface soil is moistened, which attracts the feeding roots to the surface, where they quickly perish.

Cultivation.—Keep the soil loose, mellow and free from weeds throughout the season by frequent cultivation. An adjustable one-horse cultivator is a good tool to use. Run close to the plants at first and as the runners stretch out into the space between the rows, close up cultivator allowing the plants to set thickly in matted rows two feet wide, thus leaving a two-foot path between rows. Care should be taken to keep the rows full by training runners so as to fill gaps. If the ground is rich and the season favorable too many plants may set. In this case as the season advances remove the surplus plants until they stand about six inches apart.

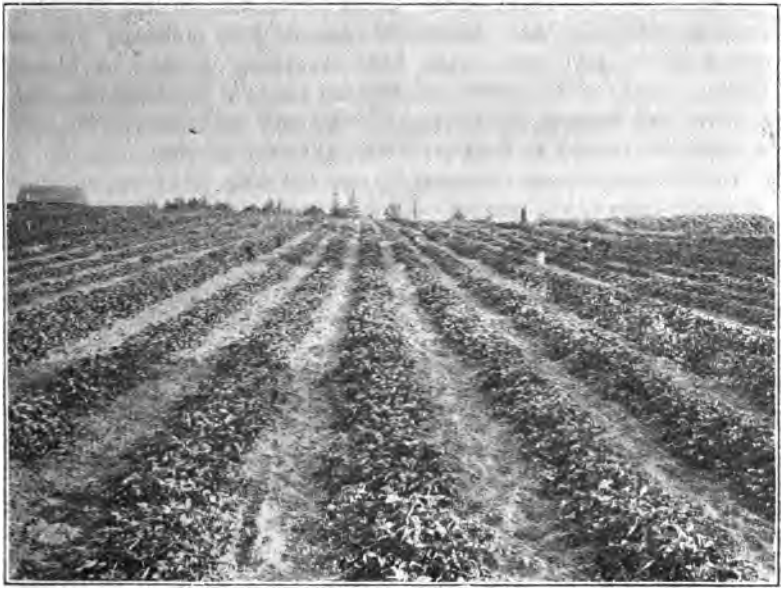

FIG. 10. Illustrating the "matted row" system of strawberry culture.

Remove all blossoms from the parent plants as soon as they appear. All of the energies of these plants must be directed to plant making the first season and not wasted in the production of flowers and fruit. At the end of the season we should have a bed that will appear like the one shown in Fig. 10.

Winter Protection.—As soon as the ground is slightly frozen in the fall the bed should be lightly covered with clean straw, or better still, marsh hay. This covering is not designed to prevent freezing but to prevent alternate thawing and freezing. Some growers use sawdust for covering with good success.

One Year After Planting.—After settled warm weather has arrived and the plants begin to push into growth the winter mulch should be removed. A large part of it may be raked into the paths between the rows, where it will serve to keep down weed growth as well as preserve moisture. Some growers remove the mulch entirely and cultivate the space as in the preceding season. In this case the mulch must be replaced as the fruit begins to ripen in order to keep it clean. The bed should be kept free from grass and weeds which will appear in abundance among the plants in the matted rows. If all these things be done we should be rewarded in June with an abundance of fruit.

Protection from Frost.—Late spring frosts may destroy the blossoms, as these are very susceptible to cold. The mulching may be used to cover the plants when frost threatens. It may be forked lightly over the plants after sundown and removed the next morning. It serves as a blanket, retaining the heat about the plants. This may be repeated as often as frost threatens, at slight expense.

The Second Season—Renewal.—After the fruit is harvested mow the plants close to the ground, rake the bed free of the cut leaves and mulching and burn them. In this way insects and diseases are destroyed; then plow a shallow furrow from each side of the row into the paths, leaving a strip of plants about 8 inches wide; clean out this narrowed row, cutting out the old plants and as many others as may be necessary to leave the plants 8 to 10 inches apart. After this cleaning and thinning cultivate as in the first year and if season is not too dry these remaining plants will send out runners and again form matted rows. By taking a new portion of the row each year for the renewal the plantation might be continued indefinitely, but in practice it is scarcely profitable. It is generally considered less expensive and more satisfactory to plant a new bed once in two years at most, and many good growers retain the plantation but one year.

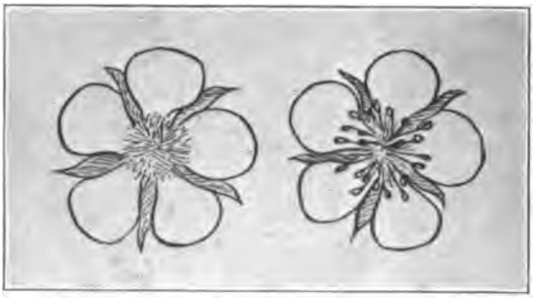

FIG. 11. Showing an imperfect or pistillate strawberry flower.

FIG. 12. A perfect or staminate flower.

Varieties.—Some varieties of strawberries produce only imperfect flowers similar to the one shown in Fig. 11. These flowers have no stamens and are therefore incapable of self-pollination. It is important to keep this fact in mind when selecting varieties, for if imperfect-flowered varieties only are selected no fruit will be borne. A small part of the plantation at least must be of kinds bearing perfect flowers like the one in Fig. 12. Nurserymen indicate in their catalogues the imperfect varieties by the abbreviation "Imp."

The amateur as well as the professional soon learns that in the selection of varieties he must be guided by local condition of soil, climate, etc., and that no list can be given that will be satisfactory over any wide area.

The following is given as a "trial list." All are well known to commercial growers and are fairly satisfactory under widely varying conditions:

Perfect-Flowered: Bederwood, Splendid, Lovett.

Imperfect-Flowered: Warfield, Haverland, Crescent, Glen Mary.

If but two varieties are wanted, Bederwood and Warfield may be selected, the former early, the latter midseason to late.

Acknowledgements.

Figs. 1 and 2 are from Bull. No. 7, Missouri State Fruit Experiment Station, and are used by permission of the Director, Mr. Paul Evans.

Figs. 3, 4, 5, 7, 8 and 9 are from Principles of Plant Culture by E. S. Goff and are used by permission of the University Co-Operative Association of Madison. Fig. 10 is used by permission of Coe, Converse and Edwards Co., Ft. Atkinson, Wis. Figs. 6, 11 and 12 are from original drawings by Miss Jennie Pitman of Madison.

WISCONSIN

State Horticultural Society

BULLETIN NO. 5

Published by authority of the Executive Committee

FIRE BLIGHT

MADISON, WIS., MAY, 1905

☞ The Bulletins and Annual Reports of this Society are sent free to members of the Society

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INTRODUCTION

The disease affecting apple and pear trees known as Fire Blight has been discussed in this Society for 35 years according to the Annual Reports.

During this time about every member in regular attendance at the meetings has had a turn at "blight," but it still remains to vex the orchardists of the state, professional as well as amateur. That the disease is still prevalent is shown by the numerous inquiries received at this office. In order to reply conveniently to these questions it was thought best to issue a pamphlet giving a brief history and description of the disease as well as approved remedies. In looking over the literature on the subject a press bulletin by Prof. Henderson of the Idaho Experiment Station seemed to afford the desired information presented clearly and concisely and it is hereby reproduced by courtesy of Director H. T. French of the Idaho Station.

F. Cranefield, Editor.

UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION
MOSCOW, IDAHO.

L. F. HENDERSON, Botanist

FIRE BLIGHT

A Bacterial Disease of the Pear and the Apple.

Spring is now upon us,—the time when the careful horticulturist must be preparing to combat those many ills incident to fruit culture, whether of an insect or of a fungous nature. Of all these probably the Fire Blight is the worst and most to be dreaded.

The name "Fire Blight" is the proper one to use; it should not be called "Pear Blight" for two reasons. In the first place it is liable to be confused with the Pear-leaf Blight, a disease which attacks the leaf of the pear, and incidentally injures the fruit. In the next place this disease is not limited to the pear; it is fast becoming too common on the apple as well, in our state. Nay, in many states it attacks all of the pomaceous fruits, such as pear, apple, quince, crab and hawthorn.

HISTORICAL.

Though this trouble has been known as working havoc in orchards for a century or more, it is only in comparatively recent times that its true nature has been well understood. For a long period of years the discussions of this trouble were of such a theoretic nature that many horticultural societies forbade its being brought up in their meetings, unless someone had something of absolute knowledge to offer about it. Various causes were ascribed for its presence, such as "sour sap," "atmospheric conditions," "soil conditions," and "effects of various fungi." In 1878, however, Professor Burrill of Illinois discovered the true cause and announced his discovery to the world. This was found to be a bacterial disease, due to the presence of myriads of little germs in the inner bark and cambium. The germ was called by Prof. Burrill **Micrococcus amylovorus** from the eagerness with which it seizes upon and devours the **starch** in these tissues. From the subsequent studies of Arthur at the Geneva Station in New York, and of Waite in the U. S. Department of Agriculture, we know how this germ or bacterium lives, reproduces itself and is carried from tree to tree.

APPEARANCE OF BLIGHT.

Luckily the disease is a very conspicuous one, which renders its presence in an orchard the more inexcusable when well known. It affects, twigs, leaves, young fruit, and even the branches or trunks. From the experiments of Waite it has been found that it cannot attack the plant through the uninjured bark or leaf. It can, however, gain entrance through any injured place on trunk, limb or even leaf. Its most common points of entrance are natural ones. These are the young growing tips of the branch, the stigma of the flower, or the glands which secrete nectar. Therefore the "flower-blight," the "twig-blight" and the "branch or trunk blight" are all forms of this disease.

In the first, the young twig, especially if it be growing rapidly, turns black in both leaf and stem, and wherever the leaves are blighted they remain black and dead through the ensuing winter. This black, piratical flag is the surest evidence of its presence.

In the "flower-blight" a whole bunch of flowers, or frequently every bunch on the tree will be affected, and dying back to the beginning of the spur, hold the blackened flowers and young fruit also through the entire year. This is the most common form on the apple.

Frequently an entire limb or even the trunk will be affected for only a short distance, while the top will still be entirely free from the disease, and this can only be understood when we speak of how the disease is spread.

More frequently upon the pear several limbs and even the whole trunk will be affected, and when this is the case the tree should be cut out root and branch.

MEANS OF DISSEMINATION.

If the young shoots of a tree affected with blight be examined, small drops of sticky, thick fluid will be found exuding from the edge of the diseased area. If one of these drops be examined with a high power of a microscope, myriads of little oblong bodies will be seen, some separate, some in short chains. These are bacteria. Arthur proved that these bodies, inoculated into a sound tree by a needle, would produce the disease; Waite proved to us beyond dispute that insects, especially bees, are the main instruments in their dissemination. They are attracted by the viscid sap, suck up part or all of the drop, and then carry thousands of these germs with them to innoculate flowers, shoots, or wounded places in the bark. Undoubtedly heavy currents of wind assist in spreading the disease and probably account for the commonness of "twig blight." The question comes right here: Shall I keep bees if I have an orchard? Certainly, and for two reasons. First, the honey, and the revenue derived from it, are often no small object to the farmer. Second, the bees are absolutely needed to assist in proper cross-fertilization or pollination of the flowers. This leads us to the subject of remedies, for **preventives** there are none.

REMEDIES.

As soon as the bacteria are carried to young flower or wound, they effect entrance, and living upon the sap and starch, multiply rapidly. If they gain entrance along a limb or trunk, they live in the **inner** bark and cambium-layer,—that layer which adds yearly to the growth of both bark and wood.

It can readily be seen from this that they are well covered, and consequently spraying does no good. **The only remedy thus far found has been and is the careful and continuous use of the saw and pruning knife.** All diseased shoots and limbs should be cut off at from 6 inches to one foot below the place of evident infection or injury, as the bacteria have always gone down deeper into the limb than **seems** to be the case from the outside. Many pruners have the habit of splitting down he bark to **see** how far the disease has proceeded, but this practice is to be condemned, as they never can see how far the disease has proceeded, and the incision of the knife may carry the bacteria from diseased to healthy tissues. If the blight is bad in either the pear or apple-orchard, the knife or saw should be **sterilized** each time it is used, by either passing it through a flame, or dipping it into weak carbolic-acid water, or into kerosene. The pruned limbs or fragments should be collected and **burned** and both pruning and burning should be done mainly in the dormant season, before the sap has started, the bacteria have awakened, and the bees are visiting the orchard. This is the best time for pruning and burning, but not the **only** one; it should be done whenever the disease makes its appearance. All large wounds should be painted over with paint as soon as the tree is trimmed, to prevent the re-inoculation through the exposed tissues. Where the blight is bad, even young shoots or water-sprouts should have their cut bases painted, for it has been known time and again that the limbs and even trunks have been innoculated through these cut stubs.

The pear is much more easily pruned for this disease than is the apple. On the former it commonly manifests itself in dead or dying shoots, limbs, or trunks, which can readily be cut away below the progress of the disease. On the apple, however, it is commonly the shoots all over the tree, and **especially the fruit spurs and their clusters of flowers**, which are most affected. Pruning here becomes a much more difficult and even serious undertaking. Where only a few shoots and fruit spurs are affected these can be cut away close to the tree, and the wound immediately covered with paint. Where, however, almost all of the fruit spurs on the whole tree have died, the best way is to cut off entire and large limbs, cover the wounds with paint, and stimulate the production of new shoots and subsequent fruit spurs. In one place my attention was called to a very interesting though sad evidence of the efficacy of bees in spreading the disease. All the splendid large apple trees near the hives were without exception seriously injured by blight, while as we proceeded on radii from the hives the blight grew less and less, and almost disappeared on the edge of the orchard farthest from the hives.

OTHER HELPS.

It has been often noticed that rapidly growing trees are more subject to blight than slower growers, and that those in low ground or "swales" are more subject than those on drier ground. Orchards should therefore be planted on well drained land, and should not be stimulated by too much water or too much fertilizer.

Though all of the varieties of the pomaceous fruits are subject to this disease, as said before, some varieties have been found more subject to the attacks of blight than others. Of the apples, the crabs of all kinds have been found very prone to blight. Amongst the pear, in most places, the Anjou, Angouleme and Seckel are most resistant, Bartlet and Flemish Beauty are less so, while the Idaho, Clapp and Winter Nellis are very subject to blight.

L. F. HENDERSON, Botanist.

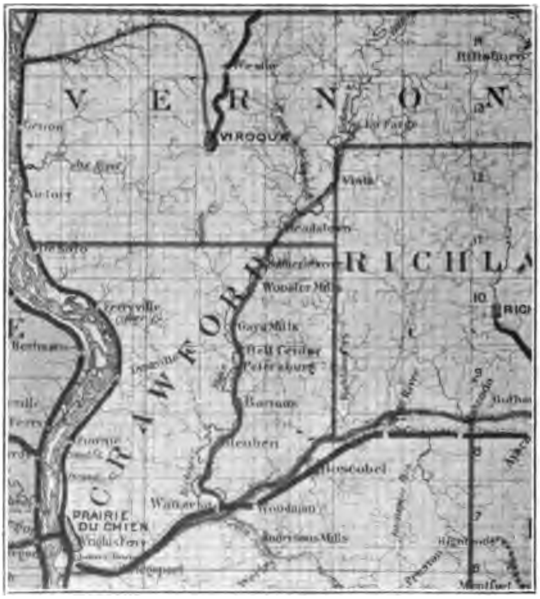
WISCONSIN

State Horticultural Society

Bulletin No. 6.

A Preliminary Orchard Survey of the Kickapoo River Region.

MADISON, WIS., OCTOBER, 1905


V E R N O N
VIROQUA
Westby
Genoa
Victory
De Soto
Viola
La Farge
Readstown
Hillsboro
RICHLA
RICH
C R A W F O R D
Soldiers Grove
Wauzeka Mills
Ferryville
Gays Mills
Bell Center
Petersburg
Barnum
Steuben
Boscobel
Wauzeka
Woodman
Andersons Mills
PRAIRIE DU CHIEN
Wright's Ferry
Bridgeport
Lynxville
Eastman
Harpers Ferry
Preston
Montfort
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13

INTRODUCTION

At the annual winter meeting of this Society in Madison, February, 1905, during a discussion of the trial orchard work, the point was raised by a member from a Southern county that the funds of the Society were largely used in developing the fruit growing interests of Northern Wisconsin while the Southern part of the state was neglected. It was proposed at that time that a trial orchard be established in Southern Wisconsin for the purpose of testing varieties. No action was taken on the matter at that time, but at a meeting of the executive committee at Oshkosh in August, the Secretary was requested to obtain, by personal investigation, as many facts as possible relating to orchard work in Southern Wisconsin, including the number and size of orchards, varieties planted, age of orchards, character of soils, etc.

A Preliminary Orchard Survey of Crawford and Vernon Counties.

In accordance with the wishes of the Executive Committee a hasty preliminary orchard survey has been made, as follows:

Believing that the high clay ridges on either side of the Kickapoo River in Crawford and Vernon Counties possessed unusual advantages for tree fruit culture this region was visited during the latter part of September. Beginning at Wauzeka, situated at the junction of the Wisconsin and Kickapoo Rivers and proceeding north along the line of the Wisconsin and Western Railroad, with numerous side trips by team, these facts were noted:

Age of Orchards.

Apple trees were planted in Crawford County as early as 1855. Many of these trees are still living. Trees forty years old are common. The Astrachan trees shown in Fig. 1 are not by any means fair examples of these old trees, but even these with proper care would prove profitable for years to come. A very large percentage of the orchards were planted from fifteen to twenty years ago with a few of later date.

Size of Orchards.

Farm orchards in the places visited are the rule and not the exception. These range in extent from a dozen to one hundred trees. It is probable that there are but few orchards of over ten acres in the county, although one orchard was reported west of Gay's Mills of twelve acres and several in the vicinity of Soldiers' Grove and Viola of three to ten acres. The largest orchard visited was one ten miles southeast of Viola, which will be referred to later.

Varieties.

In the older orchards Haas, Plumb Cider, Utter, McMahan, Newell, Fall Orange, Oldenburg, Hibernal, and Longfield predominate. In the later planted orchards, Northwestern, Wealthy, Wolf River, and McMahan are found. The most popular of these, both with growers and buyers, is the Wealthy.

Sites.

All of the orchards visited were without exception on loamy clay soil underlaid with limestone, the soil varying in depth from a few inches to several feet. A majority of the orchards are situated on level land, a few on north slopes, while some thriving orchards were found on south slopes.

Management.

The orchards as a rule receive little or no attention. For the most part pruning, tillage and spraying are unknown. Twenty-six orchards were inspected and of these but two showed evidence of pruning, none had been sprayed and all were in sod, although one orchard planted seven years had been cultivated for four years after planting.

Orchard Pests.

Fire Blight is the most common disease, appearing in every orchard visited. Scab is not, this season, as common as in the eastern and central parts of the state.

Among insects the round headed borer is plentiful in some of the older orchards, while the codling moth is troublesome only to a slight extent. A surprising feature is the general distribution in this region of the apple curculio, an insect but little known elsewhere in the State.

Markets.

As none of the towns in the valley has a population of over 800, but little fruit is handled on the local markets. Most of the apples are handled by merchants in the different towns who ship largely to Milwaukee and Chicago. From reports obtained from shippers in Viola and other places it is estimated that about 2,500 barrels of apples were shipped from the different stations from La Farge to Wauzeka in 1904.

Owing to a lighter crop this year the shipments will probably not exceed 1,500 barrels. Sorting and packing is done wholly by the buyers, the apples being delivered loose in boxes, barrels, etc.

No. 1. Astrachan tree 7 miles east of Viola. Forty years old and for 25 years neglected, it bore a fair crop the past season. With proper attention to pruning, etc., it would be profitable for many years.

The usual differences of opinion exist between growers and buyers regarding prices, but so far as could be learned the prices paid were reasonable.

The following notes are from a few of the larger orchards visited. Numbers are substituted for names of owners:

No. 1, near Wauzeka. Four hundred trees. Site, north slope Elevation, three hundred feet above the Wisconsin River. Soil,

No. 2. View of a portion of Orchard No. 5.

clay, ten to forty feet. Varieties in order of preference by owner, Plumb Cider, Fameuse, Oldenburg, McMahan, Ben Davis, Walbridge, and Haas. Trees from twelve to twenty-five years old. Culture sod, pastured; no spraying or pruning. A portion (¼) of orchard is manured each year. Will cut out all Haas trees. Former owner planted first trees in valley, but all died; then moved to ridges above mentioned.

No. 2. Sixty trees, Wolf River, McMahan, Hibernal, N. W. Greening. Sod, cuts a good crop of hay each year; no pruning; no spraying.

No. 3. Number of trees, 250. Northwestern Greening, Tetofski, Oldenburg, Utter, Plumb Cider, and others. Sod, pastured; neither pruned or sprayed.

No. 4. This orchard was the best visited; seven acres, or about eight hundred trees, which were well pruned and altogether in excellent shape. The orchard was cultivated and cropped the first four years after planting, the last four years in sod, from which a heavy crop of hay is cut each year. A promising young orchard, but will soon be starved if the present practice of double cropping is followed. Some of the varieties set are Northwestern Greening, Haas, Mackintosh, Wealthy, and Pewaukee. The owner, if planting now, would set largely as follows, in the order given: Northwestern Greening, Wealthy, Mackintosh, and Newell.

No. 5. One acre, about one hundred trees, largely Longfield, Wealthy, and Wolf River. Planted fifteen years. Trees showed evidence of care in beginning, but entirely neglected by present owner. A good crop of fruit had been allowed to drop; offered for sale and rejected (properly) by buyers; ground cover of grass, weeds and broken branches. Owner says fruit-raising does not pay. One hundred dollars might have been realized from the crop if it had been properly handled.

Conclusion.

From this hasty glance at a portion of the Kickapoo River region it is evident that the high clay ridges which comprise the

No. 8. View of a portion of orchard No. 4.

larger part of this region are well adapted in every respect to tree fruit culture.

Apple trees were planted by the earliest settlers at least fifty years ago and many of these trees still survive in spite of utter neglect. For some reason scab and codling moth are not as troublesome as in other portions of thte State. The market conditions are improving. Until recently, three to four years, if apples were shipped at all it was by the growers. The merchants of the different towns are now handling the crops in a fairly satisfactory manner and as the acreage increases and cultural conditions and methods of handling the crop improve there will be less difficulty in marketing the crop to advantage. The farmers as a rule are interested to a surprising extent in fruit raising. With proper encouragement and help to the growers this region could be developed into one of the best apple growing sections of Wisconsin. In no other section of the State are conditions more favorable for apple growing. The establishment of a trial orchard in this region would be helpful eventually, but the growers need *present* help rather than *future* results.

By action of the Board of Managers in session October 5th it was determined, if funds permit, to make a more complete orchard survey of this section. Two men of good address and thoroughly familiar with the best methods of apple culture in Wisconsin should traverse as large a part of the county as funds will permit, collecting data regarding present conditions, which will serve as a basis for the future work, and at the same time offer helpful suggestions to the growers.

If, in addition to this, a neglected orchard of one hundred trees or less in a condition similar to No. — could be leased for five years and renovated it would prove of inestimable value as an object lesson. Demonstrations in spraying could also be conducted at some central point which might prove of great value to the growers.

F. CRANEFIELD,

Secretary, W. S. H. S.

WISCONSIN

State Horticultural Society

BULLETIN NO. 7

BUYING NURSERY STOCK

MADISON, WIS., DECEMBER, 1905

☞ The Bulletins and Annual Reports of This Society are sent
free to members of the Society

Wisconsin State Horticultural Society

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Annual Membership	$1.00
Life Membership	$5.00

BUYING NURSERY STOCK.

F. CRANEFIELD.

In procuring fruit trees, plants, flowering shrubs, etc., the farmer as well as the city dweller is dependent on the nurseryman. On the farm the grain seeds and often the grass seeds used are home grown, but it is not practicable for the farmer to produce his nursery stock. In the case of fruit trees a knowledge of grafting is necessary as well as the after care and cultivation of the trees for two or three years or until large enough to set in permanent places. The professional fruit-grower may possibly do this with profit, but it is not advisable to combine farming with nursery work when but small quantities of stock are required.

For the purpose of aiding prospective buyers the following suggestions and fruit lists are given.

When to Buy

Buy in the winter for early spring delivery. Trees bought for fall delivery must either be planted at once or "heeled in." While root growth may begin to some extent in fall planted trees the drying and freezing which the trees must withstand for probably six months is apt to result in injury. Trees delivered late in the fall are usually "heeled in" by the buyer, the trees partially or wholly buried until spring.

Nurserymen as a rule are provided with storage sheds or cellars where the trees and plants, dug late in the fall, are stored with roots kept moist and the temperature of the storage-room held near the freezing point. Here the stock is held dormant and well protected and if forwarded to the buyer early in the spring and planted as soon as received, better results will be obtained than by fall planting or "heeling in."

Where to Buy

Buy of a reliable firm, one having a permanent place of business and a reputation to maintain. If buyers of nursery stock would proceed as in other business transactions there would be fewer complaints of fraud. A farmer, for instance, would be considered lacking in ordinary business sagacity who would buy live stock of an agent or firm wholly unknown to him, and yet that is what many do in buying nursery stock. Representatives of reliable firms will have no difficulty in proving their reliability.

What to Buy

Hardiness, the ability to withstand extremes of heat and cold, is a very important consideration in the selection of varieties. Even if the requirement of hardiness is satisfied there still remain other considerations, for the behavior of varieties is influenced very largely by environment. The conditions of soil, exposure, etc., over such a large area as Wisconsin vary greatly and no extended list can be given that will prove satisfactory in all localities.

As a partial guide to the selection of varieties the following Fruit Lists adopted by this Society are here given.

Lists of Fruits Recommended for Culture in Wisconsin

APPLES.

Alexander, Avista, Astrachan (Red), Ben Davis, Dominion, Fall Orange, Fameuse (Snow), Golden Russet, Haas, Hibernal, Lowland Raspberry, Longfield, McIntosh, Malinda, McMahan, Newell, Northwestern Greening, Oldenburg (Duchess), Patten Greening, Perry Russett, Pewaukee, Plumb Cider, Scott, Tolman (Sweet), Utter, Wealthy, Westfield (Seek-no-further), Willow Twig, Windsor, Wolf River, Yellow Transparent.

Five Varieties for Farm Orchard.

Lowland Raspberry, Northwestern Greening, Oldenburg (Duchess), Plumb Cider, Wealthy.

Of the above lists, Astrachan, Lowland Raspberry, Oldenburg and Yellow Transparent are summer apples.

Alexander, Haas, Hibernal, Longfield, McMahan, Patten Greening, Perry Russett and Wolf River are fall apples. Of these the McMahan, Haas and Patten Greening are in season during September keeping but a few days after ripening. The Alexander and Hibernal may be held for a longer time while under favorable conditions the Wolf River, Perry Russet and Longfield may be held easily until November 1st, the keeping qualities being in the order named.

McIntosh, Pewaukee, Plumb Cider, Scott, Utter, Westfield and Wealthy are late fall or early Winter varieties. The remainder may be classed as winter apples.

CRABS.

Hyslop, Lyman, Martha, Sweet Russett, Whitney.

If but two varieties of crabs are selected Sweet Russett and Whitney will usually meet all requirements. The latter is a large crab sometimes being classed as an apple and if a smaller crab is desired for domestic uses the Hyslop or Martha may be selected.

PLUMS.

Of the three classes of plums commonly cultivated, viz., European, Japanese and Native or American, the Native is the most reliable.

NATIVE.

Forest Garden, Hammer, Ocheeda, Quaker, Surprise, Wyant, De Soto.

EUROPEAN.

Lombard, Moore's Arctic, Reine Claude (Green-gage).

JAPANESE.

Abundance, Burbank, Red June.

CHERRIES.

Early Richmond, Montmorency.

GRAPES.

Brighton, Concord, Delaware, Diamond, Green Mountain, Moore's Early, Worden.

BLACKBERRIES.

Badger, (Ancient) Briton, Eldorado, Snyder.

STRAWBERRIES.

Varieties starred have imperfect flowers and must not be planted alone.

Bedwood, *Crescent, Clyde, Dunlap, Enhance, Gandy, Glen Mary, *Haverland, Lovett, *Sample, Splendid, *Warfield.

Two varieties of strawberries for the farm garden.— Dunlap, *Warfield.

RASPBERRIES.

Black— Conrath, Gregg, Kansas.
Red— Cuthbert, Loudon, Marlboro.
Purple— Columbian.

CURRANTS.

Red— Red Dutch, Long Bunch Holland, Victoria.
White— White Grape.
Black— Lee's Prolific, Naples.

GOOSEBERRIES.

Downing.

PEARS.

On account of the prevalence of blight and winter killing, pears are not generally recommended for Wisconsin. Good crops are occasionally produced under favorable conditions, especially in the southeastern part of the state. The following list includes both early and late varieties. List prepared by W. J. Moyle.

Bartlett, Clapp Favorite, Early Bergamont, Flemish Beauty, Idaho, Kieffer, Lawson, Seckel, Sheldon, Vermont Beauty.

LIST OF SHRUBS RECOMMENDED.

Common Barberry, Purple-leaved Barberry, Thunberg's Barberry, Purple Filbert, Weigela (rose), Weigela (white), Desboi's Weigela, Silver Berry, Strawberry Tree, Althea, Sea Buckthorn, Garden Hydrangea, Ruprecht's Honeysuckle, Tartarian Honeysuckle, Amur Privet, Tea's Weeping Mulberry, Mock Orange, Golden Mock Orange, Mock Orange (large fl.), Shrubby Cinque Foil, Russian Almond, Rhodotypos, Smoke Bush, Missouri Flowering Currant, Rose Acacia, Japanese Rose,

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*From Bulletin 108, Wisconsin Experiment Station, by F. Cranefield.

Golden Elder, Bumalda Spiraea, Anthony Waterer Spiraea, Billard's Spiraea, Douglas' Spiraea, Japanese Spiraea, Meadow Sweet Spiraea, Van Houten's Spiraea, Persian Lilac, Chinese Lilac, Common Lilac, Amur Tamarix, Snowball.

ROSES.

Hardy garden—Harrison Yellow, Persian Yellow, Madame Plantier.

Twelve varieties hybrid perpetual—Paul Neyron, Mrs. J. H. Laing, Gen. Jacqueminot, Dinsmore, Marshall P. Wilder, Coquette des Blanches, Earl of Dufferin, Jules de Margottin, Vick's Caprice, Magna Charta, Prince Camille de Rohan, General Washington.

Moss roses—Perpetual White, Salet, Paul Fontine, Henry Martin.

Climbers—Prairie Queen, Russel's Cottage, Seven Sisters, Gem of the Prairies, Crimson Rambler.

Comparative Height at Maturity of Different Shrubs.

The height at maturity of the different species must be considered when planting in groups or borders. This will depend so much upon their environment that it is difficult to give the height in feet that any species may be expected to attain. When different kinds are planted under like conditions it may be assumed that relative heights will be maintained. The following may serve as a partial guide in planting:

TALL—10 TO 15 FEET.

Barberry (Common)
Barberry (Purple-leaved)
Cornelian Cherry
Golden Elder
Honeysuckle, Fly
Honeysuckle, Slender
Honeysuckle, Tartarian
Honeysuckle, Tartarian white
Lilac, Common
Lilac, Japanese
Lilac, Jossika's
Mock Orange
Privet
Sea Buckthorn
Siberian Pea Tree (tall)

MEDIUM — 6 TO 10 FEET.

Crandall Currant
Honeysuckle, blue
Japanese Rose
Lilac, Chinese
Purple Filbert
Rose Acacia
Russian Almond
Siberian Pea Tree (dwarf)
Silver Berry
Strawberry Tree
Spiraea, Billiards
Spiraea, Douglas
Spiraea, Three-lobed
Spiraea, Van Houten's
Weeping Mulberry
Wigelas

DWARF — 2 TO 6 FEET.

Althea
Barberry, Thunberg's
Cinque Foil
Honeysuckle, Albert's
Hydrangea
Rhodotypos
Spiraea, Anthony Waterer
Spiraea, Ash-leaved (Sorbaria)
Spiraea, Bumalda
Spiraea, Japanese
Spiraea, Meadow Sweet
Spiraea, Plum-leaved

CONCLUSION.

It must not be assumed that the varieties named above are the only ones that will succeed, but in a selection of a list for the home it is well to limit it to well known and tested varieties. The testing of novelties may best be done by the specialist. These lists contain only varieties that have been thoroughly tested in some part of the State and known to succeed.

A list of unworthy varieties is more difficult to compile, as the success or failure of any variety which is reasonably hardy will often depend upon local conditions or the skill of the grower. It may be stated however without fear of contradiction that neither peaches nor quinces thrive in Wisconsin.

In general such varieties of apples as Jonathan, Tompkins King, Hubbardston, Mann, Grimes Golden, Newton, etc., are not considered hardy. The Winter Banana apple has not proven successful where tested. The Bismark apple is valuable only as a curiosity. Japanese and European plums succeed best in Door County peninsula and along the Lake Michigan shore. Native plums thrive in all parts of the State.

Ornamental plants that have been tested and proven unreliable with thorough winter protection are as follows: Rhododendron, Azalea, Daphne and Privet.

WISCONSIN

State Horticultural Society

BULLETIN NO. 8

PRUNING ORCHARD TREES

MADISON, WIS., MARCH, 1906

☞ The Bulletins and Annual Reports of This Society are sent
free to members of the Society

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PRUNING ORCHARD TREES

F. CRANEFIELD.

Pruning is the removal of a part of a plant, in order that the remainder may better serve our purpose.—Goff in Principles of Plant Culture.

It is the office of the gardener to assist nature. In every neglected tree top may be found evidence of pruning, rudimentary branches that have failed to develop for lack of air and sunlight; branches broken by wind or affected by disease and removed by the processes of decay. This is natural pruning. The skilled gardener anticipates these contingencies by careful and regular pruning.

In order to prune intelligently it is necessary to be acquainted with the principles of plant growth. A brief outline of some of these follow:

How Plants Feed.

The food of plants is derived almost wholly from the soil. This crude (undigested) material is taken up by the roots and conveyed through the outer wood layers to the leaves, where by action of the sunlight it is changed (digested) and distributed to bud, branch and root to be used in growth or stored as reserve.

It follows from this that the removal of any large part of the leaves,—pruning in summer,—deprives the plant of its power to assimilate food,—checks wood growth. In like manner the removal of roots, at any season, checks wood growth by depriving the plant of the power to appropriate food.

Balance Between Root and Branch.

Under normal—undisturbed—conditions a balance exists in a tree or plant between roots and top, i. e., a certain number of roots for a certain number of buds and branches.

The removal of one without disturbing the other upsets the balance. If a farmer who is feeding 20 cows sells five he does not continue to furnish the remainder with food for 20 but cuts it down to 15 rations. The tree, however, does not possess the faculty of reasoning, and if one-fourth of its branches are removed during the dormant period when feeding time, spring, comes again the roots send up food for all. The result is greatly increased wood growth, the revival of dormant buds and in some cases growth of sap-sprouts. Conversely root-pruning without a corresponding removal of branches causes a check to wood growth.

Length of Growing Season.

Orchard trees in Wisconsin grow, in length of shoots, but little after midsummer. Growth during the remainder of the season is in the direction of wood maturity, the ripening of fruit, and the development of fruit buds for the following season.

From these facts the conclusion may be drawn that pruning during the dormant season induces wood growth and pruning in summer, i. e., pinching shoots early in summer to check wood growth, or removing branches later in summer induces fruit bearing.

Checking Growth Induces Fruit Bearing.

Any practice which serves to check growth, if it does not interfere with the health of the plant, will induce fruit-bearing. While this principle may not be as readily demonstrated as the others, it is yet a matter of common observation.

Buds.

Two kinds of buds may be observed on orchard trees during the leafless season, leaf-buds and flower or fruit-buds. These may usually be distinguished by a difference in size and position, the leaf-buds, those which in spring will produce only leaves, being smaller than the fruit-buds and lying closer to the branch.

In the apple and pear the fruit buds are borne on spurs, i. e., short and thickened branches.

Fig. 1 shows spurs of the apple. *A* points where apples were attached the preceding year and *W* points at which leaves were attached. Fig. 2 shows leaf buds of the apple, and Fig. 3 a fruit spur of the pear. The leaf buds of the pear are like those of the apple. Fig. 4 shows clusters of fruit buds of Morello cherry, and Fig. 5 a branch of European plum, the portion marked *A* bearing fruit buds and *B* leaf buds. Leaf buds and fruit buds are also shown in Fig. 6, all one-fourth natural size.

How Wounds Heal.

The stems of fruit trees consist of, (a), the bark, (b) the cambium layer or sap carrier, (c) a layer of softer sap-wood, and (d) a central cylinder or heart-wood. The heart wood never heals. When a branch is properly cut in pruning the wound

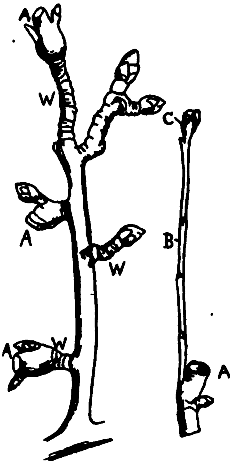

Fig. 1

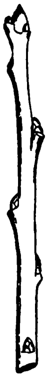

Fig. 2

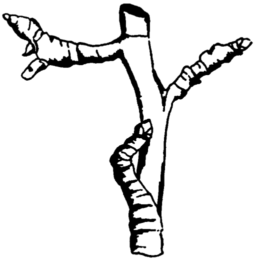

Fig. 3

Fig. 1. Fruit buds of the apple borne on short and thickened branches called spurs. In addition to the plump fruit buds shown each spur bears one or more leaf buds and when the fruit buds fail, or following heavy pruning these sometimes push out into slender leaf bearing branches as shown in the right hand illustration. Fig. 2. Leaf buds of the apple. These buds develop into branches, either slender leaf bearing branches (wood) or short fruit spurs depending on different conditions one of which is rational pruning. Fig. 3. Fruit spurs of the pear. The pear and apple are alike in fruiting habits.

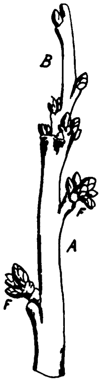

Fig. 4

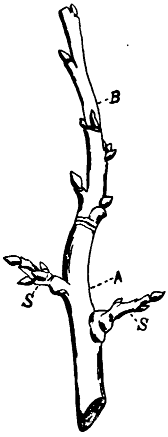

Fig. 5

Fig. 4 Fruit buds of the cherry. Each of these clusters contain one or more leaf buds. On old cherry trees the fruit is borne on the outside of the tree because the spurs in the center of the tree perish for lack of light. An occasional heavy pruning serves to renew the fruiting wood of such trees. Fig. 5. Branch of Green Gage Plum. Explanation in text. Figs. 1 to 5, inclusive, from Principles of Plant Culture by E. S. Goff.

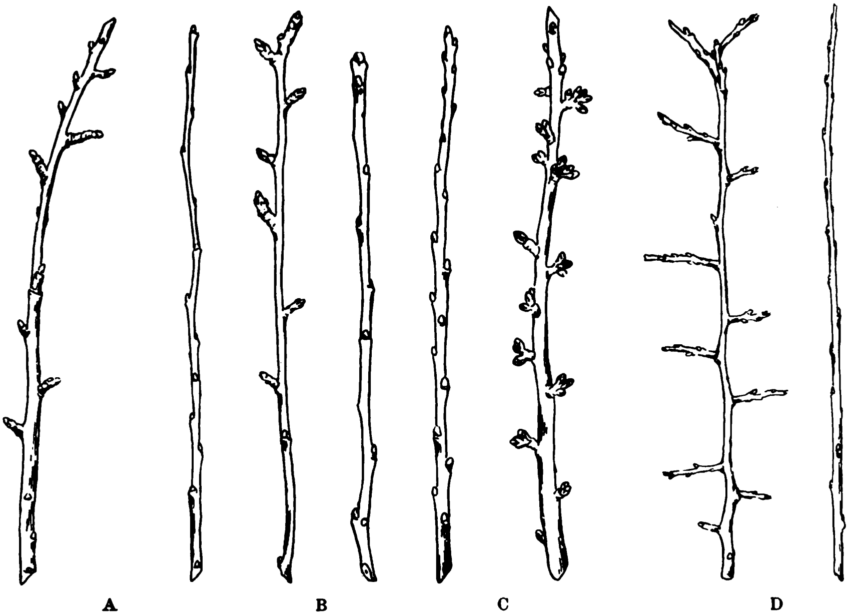

Fig. 6A. Showing leaf buds and fruit buds of A apple, B pear, C cherry, D Native plum.

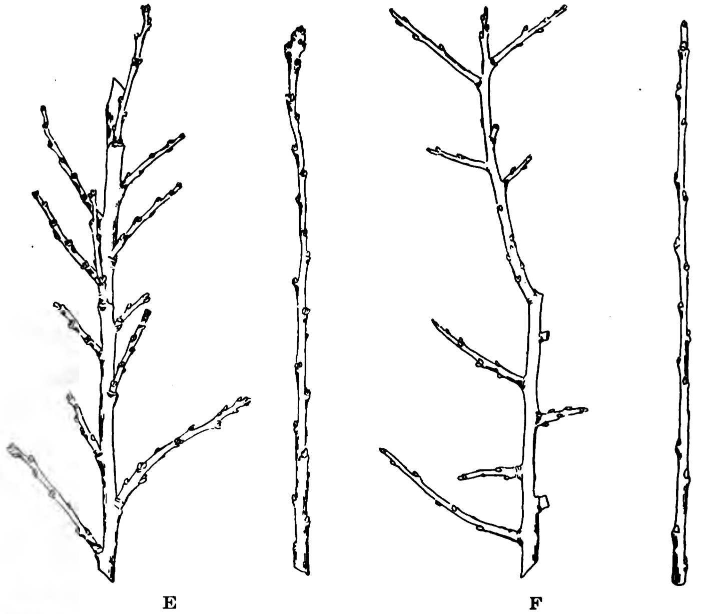

Fig. 6 B. E. European plum, F. Japanese Plum The leaf buds in every case except C on the right. One-fourth natural size. (From Nature).

is covered with a cushion or layer of woody material called callus. This callus is composed of food material prepared in the leaves above or beyond the cut.

It follows then that no callus can be formed and no healing take place unless there are leaves beyond the cut to prepare food. Stubs therefore never heal.

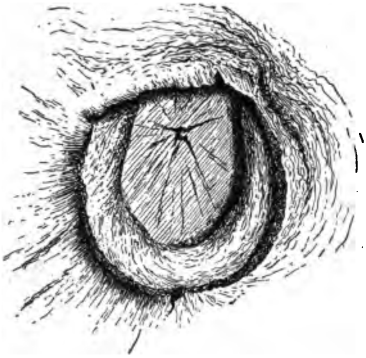

Fig. 7. Shows a ring of callus on the sides of a wound. The callus will in time cover the entire surface of the heartwood. The checking of the wood shown in the cut could have been prevented by a coat of thick paint.

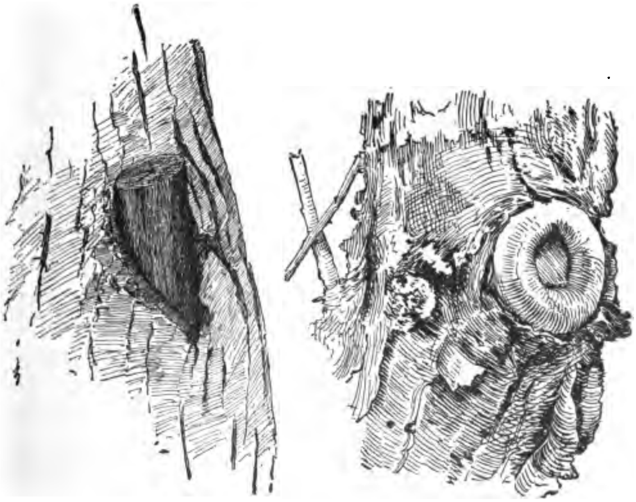

Fig. 8. Improper cutting of limb (left). Proper cutting of limb (right). The stub in the former case will never heal. The decay of such stubs usually extends to the heartwood.

In Pruning Cut Close to the Trunk and Parallel With It.

At the base of every branch will be found a bulge or swelling. In pruning the cut should be made so as to remove this or a stub will result. Figs. 8, 9 and 10 show proper and improper methods of making the cut.

Dressings for Wounds.

As the heart wood never heals and remains always moist it is essential to cover all large wounds as soon as made with some material which will prevent the entrance of germs which cause disease and decay until the callus cushion or healing tissue covers the wound. For this purpose grafting-wax* is a most excellent material. If this is not available lead and oil paint affords an excellent substitute. Wounds under one inch in diameter will usually heal in one season; all larger than this should have a thorough dressing of wax or paint.

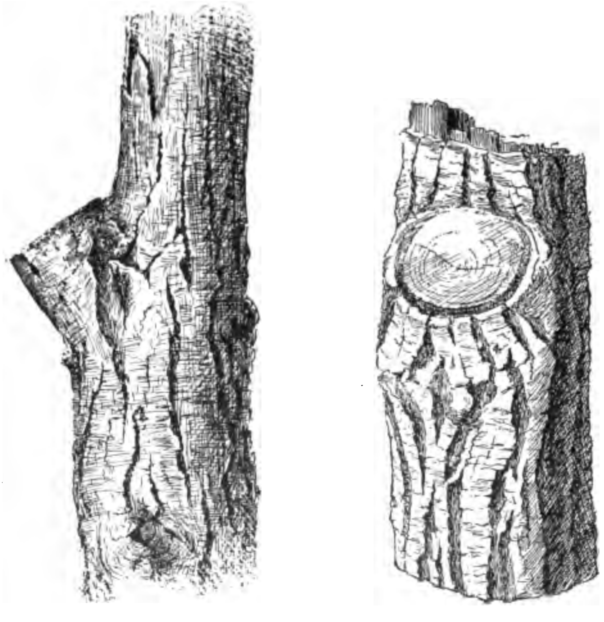

Fig. 9. Showing the wrong way to make the wound in removing large branches, side and front views. The cut has been made at a right angle to the branch rather than parallel with the trunk leaving the smallest possible exposed surface but a stub which will not readily heal, if at all.

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* A wax for this purpose is made by melting together equal parts, by weight, of beeswax, rosin and tallow; when cool enough to handle pull or knead until light brown in color and mold into shape convenient for use.

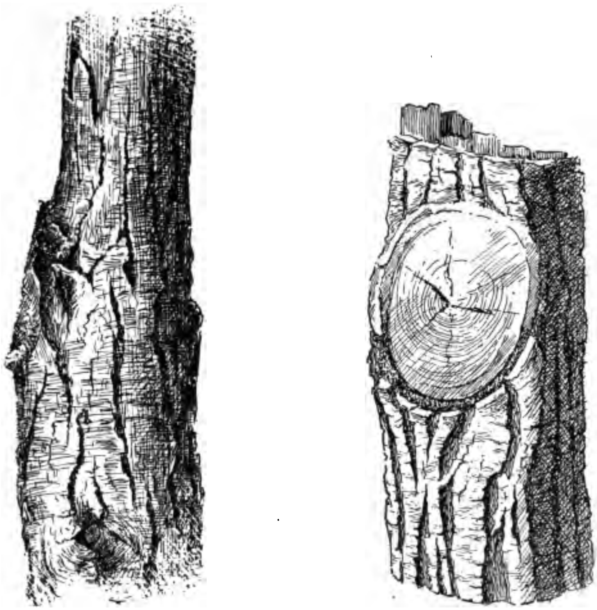

Fig. 10. Side and front views of a properly made cut. The exposed surface is greater than in Fig. 9 but the bulge at the base of the branch has been removed leaving no stub. This wound will heal rapidly.

SUGGESTIONS.

It is difficult to give definite directions for pruning and still more difficult to follow such directions, as every tree and plant possess a certain individuality which must be considered in pruning.

The orchardist's beginning in pruning comes when the trees are planted. Before the tree was removed from the nursery row it had sufficient roots to supply all of its buds with water. In digging most of the roots were removed without a corresponding reduction of the buds, thus disturbing the normal balance. As soon as warm weather comes after planting every healthy bud will push out and call for water to feed its new-born leaves. As many of the roots which formerly supplied these buds have been torn away by the tree digger and the remainder have not yet begun work the reserve supply of food and water stored in trunk and branch the previous season must be used; if this is exhausted before new roots can be developed the tree will perish.

We must then reduce these water pumps or buds to correspond to the reduced root-system. An illustration of the method of doing this is shown in Fig. 12. The drier the ground and the weather the more we should cut off.

The Formative Period.

Pruning at planting time involves more than the shortening of branches. Whether the future tree shall be high headed or low headed, open center or with a central axis depends in a large measure on the pruning the first season. Orchardists in the Eastern and Southern states prefer a high-headed tree with

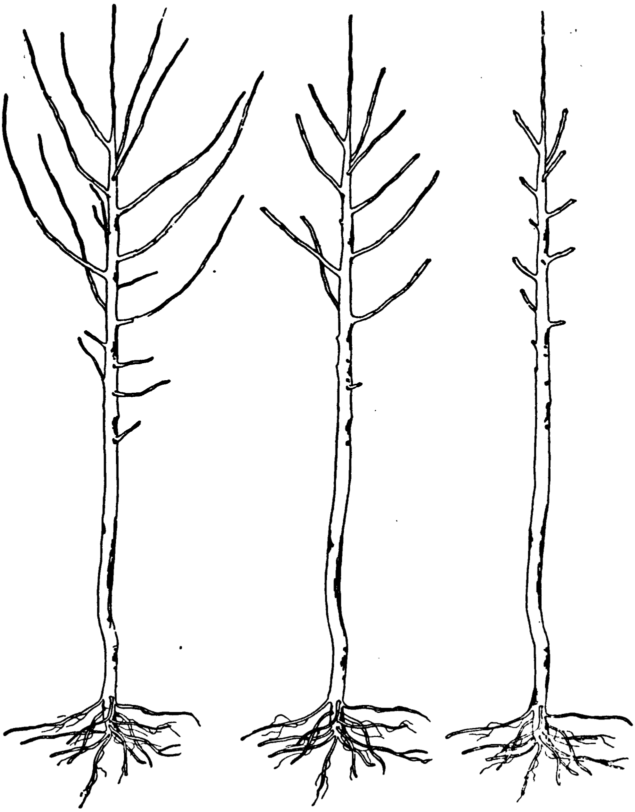

Fig. 12. Showing methods of cutting back trees at planting time. Beginning at left: No. 1, unpruned; No. 2, pruned sufficiently if the tree is well planted in moist ground; No. 3, showing extent of pruning necessary for weakened trees and trees set in dry weather.

an open top. In Wisconsin such trees are apt to suffer from sunscald and wind storms. Trees headed 18 to 24 inches from the ground are to be preferred.

Nursery grown trees are usually headed much higher than this, commonly three and four feet, due to crowding in closely planted rows. It is difficult if not impossible in the case of such trees of the apple, pear and cherry to lower the head or induce heading at 18 to 24 inches by pruning at time of planting. The remedy lies in planting younger (two year old) trees or in demanding trees with lower heads. Nurserymen, like other producers, are willing and anxious to provide what the market demands.

In pruning the newly-set tree it must not be forgotten that the framework on which the branch system is built is determined at this time. Aim to leave the main branches, the "scaffold" limbs, spirally about the stem rather than opposite. The lower opposite branches in fruit trees form bad forks that may split down later and ruin the tree.

Pruning the second and succeeding years will consist mainly in removing crossing and interfering branches and correcting as far as possible the faults of the tree that it may approach the ideal of the grower. In from two to five years from planting, according to the species, the tree will have assumed the bearing habit and less pruning will be required. It is not well, however, to entirely neglect the tree in respect to pruning. Regular, annual pruning insures stability, while if pruning is neglected for three or four years followed by heavy pruning the balance of root and top growth is disturbed, resulting in an increased wood growth at the expense of fruit.

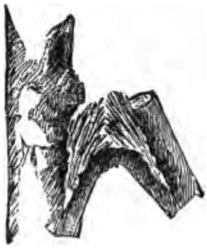

Fig. 11. The result of lack of forethought in pruning. The pruner who will do this is the one who will sit on a branch while sawing it. Figs. 7, 8, 9, 10 and 11 from the pruning book by Prof. L. H. Bailey.

Renovating Neglected Trees.

In pruning such trees the main effort must be directed to thinning the branches. The tops of neglected fruit trees will usually bear a surplus of branches as well as stubs and broken branches. The removal of these will be followed by a heavy growth of wood, a portion of which must be removed the following year, but if to pruning is added tillage and enrichment of the soil the tree will soon settle down to fruit bearing.

Season for Pruning.

"The conclusion,—and my general opinion,—in respect to season of pruning, so far as the healing of wounds is concerned, is this: The ideal time is in the spring, before growth begins . . . but more depends on the position of the wound in the tree and the length of stub than on the time of year."—L. H. Bailey in The Pruning Book.

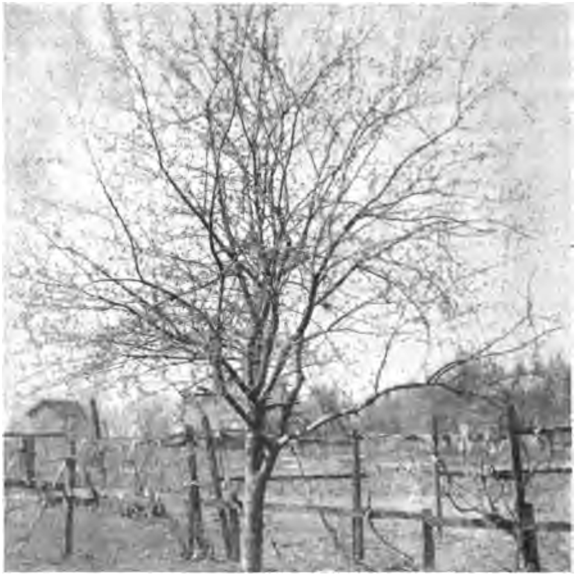

Fig. 13. An apple tree neglected with respect to pruning The numerous small branches in the center will not develop fruit buds owing to the lack of sufficient plant food.

The most favorable time for pruning in Wisconsin is March and early April, or after the coldest period of winter and before growth begins, but if proper attention is given to covering the wounds with grafting-wax or thick lead paint pruning may be done in the fall.

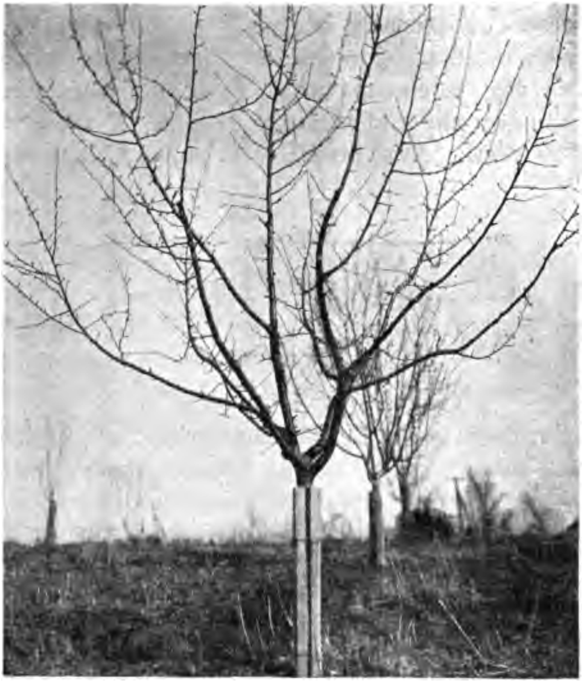

Fig. 14. An apple tree carefully pruned to admit light. It is commonly argued that the thinning of tree tops is for the object of giving color to ripening fruit. The fundamental object sought is the production of fruit buds by the admission of light and the concentration of the food supply. The development of a bud into a fruit or leaf bud is often if not always dependent on the amount of food it receives.

Summer Pruning.

Theoretically we may check wood growth and induce formation of flower buds in fruit trees by pinching or cutting back the more vigorous shoots during the growing season, but in practice it is rarely that these objects are attained. If the tips of the branches are removed too early in the season the buds immediately back of the cut will push out into secondary branches, resulting in an increased rather than a lessened production of wood. If pinching is delayed until the active growth has ceased for the season no check to growth will result.

"The greatest success will attend this process if the pinching takes place just at the period when the buds have still sufficient time to swell up and become stored with food material, but when the supply of water begins to diminish, so that the upper buds do not grow out into long laterals."

"To prevent disappointment, we state emphatically, as the practice is very common, that no fixed rule can be laid down for the commencement of summer-pruning. Trees may even be pinched to death. The favorable time for this operation depends upon the climate, the soil, the variety, and even upon the individual characteristics of the plant. The cultivator must himself judge whether the shoots have reached such a stage of maturity that an elongation of the uppermost buds will not take place."—Soraurer in The Physiology of Plants.

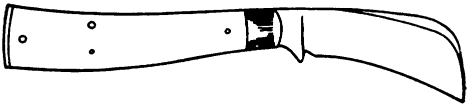

Fig. 15. Pruning knife.

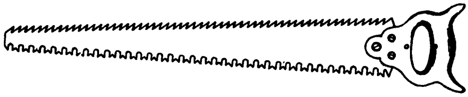

Fig. 16. Pruning saw. A "two edge" saw like the one shown above is thought to be an advantage to prevent "pinching" but it is not a necessity. Key-hole saws with detachable blades of different sizes may be had at hardware stores and are excellent pruning saws.

Pruning after midsummer, when active growth has ceased, approaches in its effect on the tree pruning during winter and early spring.

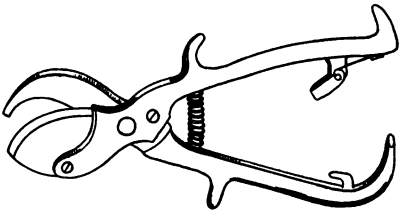

Fig. 17. Pruning shears.

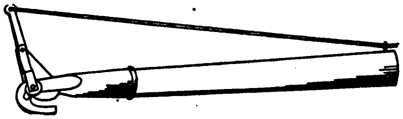

Fig. 18. Pole shears, useful in cutting back branches on tall trees, not much used in orchard work. Figs. 13 to 18, inclusive, from Principles of Plant Culture.

Pruning Tools.

The tool commonly used in removing small branches is a strong knife with a curved or "hawk-bill" blade; for large branches a pruning saw. Pruning shears are useful in pruning vines, shrubs, etc., but in pruning trees it is difficult to remove branches without leaving a stub or crushing the bark on the stem.

ACKNOWLEDGEMENTS

Figs. 1, 2, 3, 4, 5, 13, 14, 15, 16, 17 and 18 are from Principles of Plant Culture by E. S. Goff, and used by permission of the publishers, The University Co-Operative Co., Madison, Wis.

Figs. 7, 8, 9, 10 and 11 are from The Pruning Book by Prof. L. H. Bailey, and were furnished by the publishers, The McMillan Co., 66 5th Ave., New York.

Figs. 6A and 6B original.

Fig. 12 from Bulletin No. 1 W. S. H. S.

WISCONSIN

State Horticultural Society

BULLETIN NO. 9

HORTICULTURAL MISCELLANIES

MADISON, WIS., OCTOBER, 1906

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free to members of the Society

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Remit to Secretary, W. S. H. S.,
Madison, Wis.

A Remarkable Apple*

A very promising apple has been found in western Sauk county. The only bearing tree known is now 44 years old and stands in a pasture, unprotected, has never been pruned or sprayed and bears from 15 to 30 bushels of apples each year. The fruit somewhat resembles the Alexander in shape, size and color and keeps well in an ordinary cellar until March or later. In quality it is better than any other apple of Wisconsin origin and compares favorably with the best Eastern apples.

This apple has been shown for the past two years at the State Fair but attracted slight notice on account of being only partly ripe at that time. The fruit does not color much until after October 1st and its highest color does not appear until it has been picked several weeks. The origin of the tree can not be definitely ascertained, but it is very likely a seedling. The tree stands in what remains of an orchard planted forty-four years ago by Mr. Hanko, father of the present owner.

Several prominent fruit men have examined this apple but none has succeeded in identifying it as a standard named variety and all agree that it is undoubtedly a seedling. Mr. C. A. Hatch at the 1906 winter meeting said:

''Those trees were put out about forty years ago, about a half dozen trees. The man had the Duchess and some crab apples. The son lives on the farm and this tree stood where one of the original trees stood. Whether it has sprouted from the root or whether he planted a seedling the son does not know, but we know that it is strictly hardy. The tree has never in its whole life been pruned or sprayed. It bears annual crops; if my memory serves me right, it bore fifteen bushels this year and thirty bushels last year. I have had the most expert men, men of national reputation, down here, examine the fruit, and they all pronounce it a seedling, different from anything they have ever seen."

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* This apple has been called ''Hanko,'' but this name has not been adopted by any horticultural body. Nov., 1906.

Mr. Brackett writes as follows of this apple:

WASHINGTON, D. C., March 20, 1906.

MR. JOHN REIS, *Ithaca, Wisconsin.*

DEAR SIR,—The second lot of apples which you sent on the 12th instant were received in good order and I have had a painting and description made of one of the best specimens. I do not recognize it as any of the named varieties and therefore think it a seedling. The apple is very handsome in appearance and in quality it is good to very good. I think it worthy of further trial.

Yours truly,

G. B. BRACKETT, *Pomologist.*

Prof. S. A. Beach of the Iowa Agricultural College says:

AMES, IOWA, November 17, 1906.

SEC. FREDERIC CRANEFIELD, *Madison, Wisconsin.*

DEAR SIR,—I have your favor of November 16th concerning the new apple. I am exceedingly interested in what you have to say with regard to this variety. There is an apple which has been grown to some extent in western New York which I would like to compare with this apple if it is possible to do so. The variety I refer to is the Twenty Ounce Pippin. It seems to me that the apple which you send is considerably superior in quality to the Twenty Ounce Pippin.* I have heard that the Twenty Ounce Pippin was distributed years ago to some extent in the Upper Mississippi Valley.

Whether the variety is one that has been previously cultivated under name or whether it is a new seedling it is certainly worthy of investigation and testing.

Sincerely yours,

S. A. BEACH.

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* It should be noted that the Twenty Ounce and the Twenty Ounce Pippin are distinct varieties.

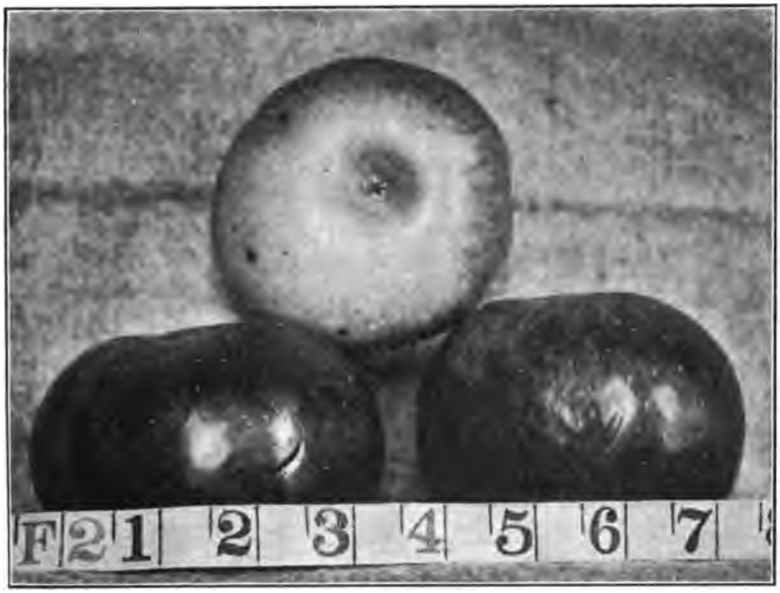

FIG. 1. FROM PHOTOGRAPH OF "HANKO" APPLE.

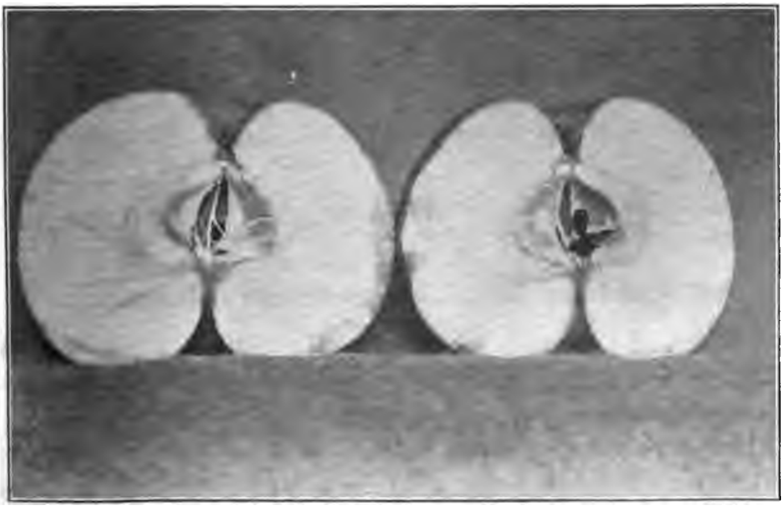

FIG. 2. CROSS SECTION OF ABOVE.

Mr. J. Reis of Ithaca, Richland county, says of this apple:

"The tree was planted by Mr. Ed. Hanko's father about 44 years ago, is as hardy as an oak and good for 44 years more. The tree is low and spreading. The apples are frequently borne in pairs. Wind storms affect them very little, for at the time of picking there was less than a peck of windfalls. It is superior to the Northwestern Greening in every respect."

Mr. Reis has propagated a number of trees, but on account of difficulty in obtaining suitable cions it will be several years before the variety can be widely disseminated. If this apple succeeds as well in other parts of the state as it does in its home it will be one of the leading winter apples in Wisconsin in a few years. A quantity of the fruit has been secured for the 1907 winter meeting.

A description of the fruit follows:

Form: Oblate, deeply furrowed and ridged.

Size: 8 to 9.

Color: Greenish yellow, ground nearly covered with broad broken strips of crimson. Shaded with beautiful bright red.

Dots: Few, large, light with dark spot in center of each.

Stem: Very short.

Cavity: Medium, abrupt, furrowed.

Calyx: Closed.

Core: Large, open.

Basin: Medium deep, abrupt, furrowed.

Flesh: Greenish white tinged with red, moderately coarse, crisp, sub-acid.

Quality: Good to very good.

Season: October to April.

An Apple of Merit for Northern Wisconsin

The Dudley, sometimes called North Star, is an apple that can be safely recommended for culture in the northern counties of this state.

The tree is very hardy, a vigorous grower and productive. The fruit averages larger than Oldenburg and ripens in October at Wausau, Marshfield and points north of these places. Farther south it ripens with Wealthy or a trifle earlier. The following history and description is from Vol. II of the "Apples of New York" by Prof. Beach:

"A seedling of the Oldenburg, which originated with J. E. Dudley, Castle Hill, Aroostook county, Maine. A few years ago it was introduced by a Rochester nursery under the name of North Star, but it was afterward found that this name had already been given to another variety and therefore the name Dudley Winter was retained for it which, according to the accepted rules of nomenclature, is shortened to Dudley.

"A very hardy and productive variety which is being planted to a considerable extent in northern New England. The fruit is pretty large, bright greenish-yellow washed and splashed with red, quite attractive in appearance and good in quality. Munson says that it is perhaps now more widely grown than any other of the newer sorts that have originated in New England. He considers it a valuable acquisition as a winter fruit for northern localities. As fruited at Geneva it is in season in September and October, although it may sometimes be kept into winter. It is recommended for trial particularly where a very hardy apple of its season is desired."

Mr. Herman Kauffman of Marshfield writes as follows of the Dudley:

"In regard to the North Star or Dudley apple, will say that the trees with which I am best acquainted were bought of a Rochester, N. Y., firm and planted in the spring of 1897. Mr. Peterson of the town of Lincoln, Wood county, planted twelve trees, of which one died and the remainder have done well, bore first fruit in 1900. These trees were planted in sod but well mulched every fall with stable manure. In 1905 these trees averaged five bushels per tree. Tree a strong grower, somewhat spreading, blights some but not more than the Duchess, quality of fruit better than Duchess, keeps well into October and does not crack and get mealy in storage as the Duchess does. Tree as hardy as Duchess so far."

The four trees of Dudley in the Wausau trial orchard are most excellent trees, showing no sign of blight or canker. These trees bore heavily in 1904 and 1906 and a fair crop in 1905.

Of the four Oldenburg seedlings in the Wausau orchard, viz.: Dudley, Milwaukee, Hoadley and Morgan, the Dudley is easily the best in all respects.

The Windorf Apple

This is a Marathon county seedling apple and should prove especially valuable for central and northern Wisconsin. It is an early winter apple, keeping fairly well under ordinary cellar conditions until December or later. The variety originated on the farm of Albert Windorf of Marathon county.

Mr. A. J. Phillips, our veteran pomologist, who top grafted the Windorf tree in the Wausau trial orchard, writes as follows:

"Yours asking about the Windorf apple received. The seeds were planted by Albert Windorf in the Town of Stettin in Marathon county, nine miles from Wausau. The seeds planted were of the Northern Spy. The old tree resembles the McMahon, is not as upright a grower as the tree I top grafted in the Wausau orchard on a Virginia crab, that is a beautiful tree. Mr. Windorf tells me it has stood 44 below zero and bore apples the next season. It does not equal the McMahon in size on an average, but is better in quality and keeps longer. Mr. Windorf has kept it and had it on his table on Easter Sunday."

A description with notes prepared from specimens from the trial orchard tree follows:

Size: Medium to large.

Shape: Oblate to conic; more or less furrowed; generally one-sided.

Color: Yellow, blushed or partly overspread with light carmine; dots numerous and distinct.

Cavity: Abrupt, deep, extending to core; furrowed; calyx open.

Basin: Broad, deep; stem medium, stout; core open.

Flesh: Greenish white, crisp, juicy, a trifle coarse; mildly acid, with flavor resembling Fall Orange.

Quality: Fair to good.

Season: Sept to Oct.

Notes: This apple does not color highly, only exposed specimens showing much red. Prevailing color when ripe, yellow. A large apple, approaching McMahon in size and excelling in flavor and keeping qualities.

Specimens from tree in Wausau orchard.

This tree was topworked on Virginia crab by A. J. Phillips in 1897 or 1898 and is fully hardy at Wausau.

A few Lessons from the Wausau Trial Orchard

APPLES.

That portion of the Wausau trial orchard known as the commercial orchard originally contained the following varieties of apples: Thirty-eight trees each of Hibernal, Oldenburg, Longfield, McMahon and Wealthy; 19 each of Peerless, Newell, Repka, Okabena and Malinda; 9 each of Hoadley, Alma, Avista, Patten and Dominion. Of these the Patten has borne more fruit per tree than any other variety named, with Hibernal, Longfield, Oldenburg and McMahon next and in the order named. The Wealthy has not done well, due largely to the fact that the trees have suffered from the apple canker. The same is true of Northwestern. The Hibernal bears heavily on alternate years and the fruit is more highly colored than when grown farther south.

The Patten bears a good crop every year. The Longfield has borne heavily alternate years and a fair crop "off" seasons, but the fruit has been too small to be salable and very badly affected with scab.

Okabena bears well alternate years, the fruit being very attractive in appearance, as good as Oldenburg and sells readily. The McMahon trees have made a splendid growth but have borne but light crops.

Peerless, Newell, Malinda, Dominion and Hoadley have not produced more than enough fruit for samples at the fairs. Avista and Alma have not responded even to this extent. Alma may be pronounced absolutely worthless as grown at Wausau and Avista, Peerless, Newell and Hoadley must soon show results or be put in the same class.

In the "experimental" portion of the orchard two trees each of about 50 varieties of apples were planted. None of these are of special merit except Dudley.

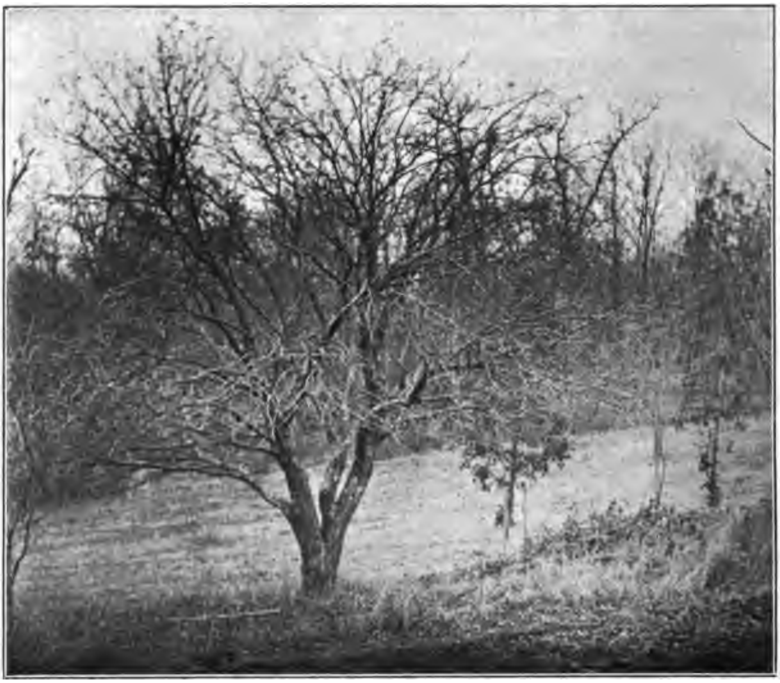

FIG. 3. THE "HANKO" TREE PHOTOGRAPHED NOVEMBER, 1906.

PLUMS.

The native plums in the Wausau orchard have degenerated into common "wild" plums. Although the varieties planted are of the best, as Surprise, Quaker, De Soto, etc., in quality and amount the crops borne have been no better than could be found in any wild plum thicket in many parts of the state. This is due to lack of proper attention in cultivation, pruning, spraying, thinning the fruit, etc.

For some reason no attempt had been made to cultivate the plum orchard until the spring of 1904 and three seasons' work has scarcely sufficed to subdue the sod and bring the ground into merely a fair state of cultivation. But little pruning has been done, the sod culture system resulted in stunted trees. and the tops a mass of fruiting wood. Conditions have been such that it was impractical to properly thin the fruit, resulting in large crops of inferior fruit, practically unsalable. Trees of similar varieties of native plums planted in the Marshall orchard at Madison at the same time have yielded immense crops of large juicy plums, which have sold as high as $2.50 a bushel. All of which teaches a valuable lesson, viz., that native plums to be profitable must have high culture. Neglect produces only "wild" plums.

CHERRIES.

The original planting consisted mainly of Montmorency and Early Richmond, but other varieties have been added from time to time. All trees have made a good growth except in one low spot of ground and are well supplied with fruiting wood, but the crop has been almost an entire failure each year, due probably to late spring frosts. The results to date in the Wausau orchard are not encouraging for cherry growing.

Our Annual Convention

The annual winter meeting of this Society will be held in Madison, February 5th, 6th and 7th, 1907.

The subject of fruit marketing is attracting much attention in the state, evidence of a rapid development of commercial horticulture; therefore, this topic will be given more time than any other on the program at the coming meeting. It is hoped to secure speakers of wide experience from all of the large apple and berry shipping centers of the United States.

Other topics of interest will be presented by our members and speakers from other states making a three day horticultural "short course." Acceptances have been received from Profs. Sandsten of Wisconsin, Green of Minnesota and Fletcher of Michigan.

Prof. Hansen of South Dakota, who is now in Europe, has been invited to attend and will no doubt accept. These, in addition to a selected list of our own members, makes a strong "cast."

Bulletins Available

No. 4, Spraying. No. 5, Fire Blight. No. 7, Buying Nursery Stock. No. 8, Pruning Orchard Trees. No. 9, Horticultural Miscellanies No. 1.

Copies may be had of any of the above on application to the Secretary. A copy of each, also a copy of the 1906 Annual Report (325 pages) and any of the following named books all sent free on receipt of $1.00 for annual membership. This applies to new members only. No one whose name appears in the membership list in the 1905 or 1906 Report is eligible to membership under the above conditions. Send remittances to Secretary.

LIST OF PREMIUM BOOKS.

Principles of Plant Culture.—By Prof. E. S. Goff.
The Spraying of Plants.—By Lodeman.
The Nursery Book.—By Prof. L. H. Bailey.
Plant Breeding.—By Prof. L. H. Bailey.
The Forcing Book.—By Prof. L. H. Bailey.
Garden Making.—By Prof. L. H. Bailey.
Fertilizers.—By Prof. E. B. Voorhees.
Fruit Harvesting, Marketing and Storing.—By Prof. W. A. Waugh.
Systematic Pomology.—By Prof. W. A. Waugh.
Home Floriculture.—By Eben E. Rexford.
Vegetable Gardening.—By Prof. S. B. Greene.
Mushroom Culture.—By Falconer.
The Garden Magazine for one year.

New members are entitled to any one of above list.

F. Cranefield, *Sec.* W. S. H. S.,
Madison, Wis.

WISCONSIN

State Horticultural Society

BULLETIN NO. 11

SEEDLESS APPLES

MADISON, WIS., JUNE, 1907

☞ The Bulletins and Annual Reports of This Society are sent free to members of the Society

Wisconsin State Horticultural Society

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Annual Membership	$ .50
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Remit to Secretary, W. S. H. S.
Madison, Wis.

Introduction

During the summer of 1905 many of the trees in the Wausau trial orchard were found to be suffering from some disease. In the case of many of the Northwestern Greening trees the foliage on one or more of the larger branches appeared dwarfed and wrinkled and later turned brown but did not fall.

On examination it was found that these branches were girdled at the base or point of union with the trunk. The bark in the crotches was brown and sunken, the injury extending through the cambium to the sap wood.

Further investigation in the orchard showed hundreds of trees to be affected, some like the Northwestern in the crotches, others having large patches of dead bark on the trunks.

It was not until the close of the growing season that it was definitely determined that the trouble was caused by the apple tree blight canker. It has since been found that the disease is widely prevalent in the state, having been found in twenty-six counties and probably exists in the majority of young orchards throughout the state, attacking the crotches and trunks of young apple trees.

The apple tree blight canker and methods of treatment were fully described by H. H. Whetzel, plant pathologist, Cornell University, at the 1906 annual meeting of this Society and the address printed in the 1906 Annual Report.

That a better knowledge of the disease and the means of combating it may be had the article is here reprinted.

F. Cranefield, Secretary.

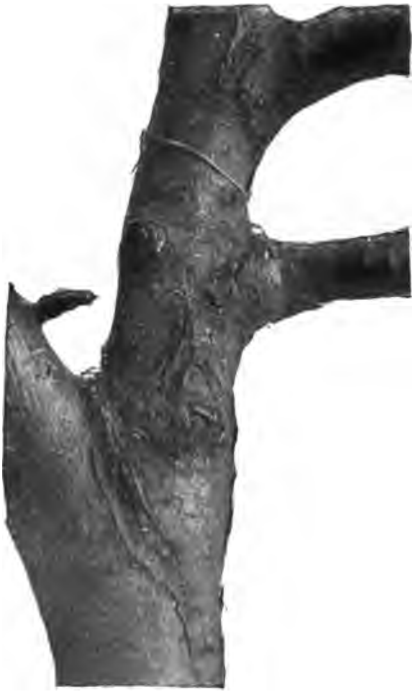


FIG. 1—Typical blight canker on main limb of young tree.

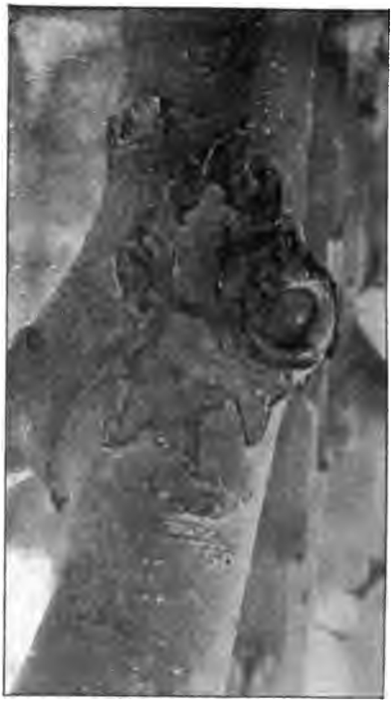


FIG. 2—Typical canker showing the crack about the margin where the diseased bark has dried away from the healthy tissue.

NOTE—Figs. 1 to 13 inclusive from Bulletin 236, Cornell University, Ithaca, N. Y. Figs. 14, 15, 16 and 17 from photographs of trees in the Wausau Trial Orchard.

The Blight Canker of Apple Trees

H. H. WHETZEL.

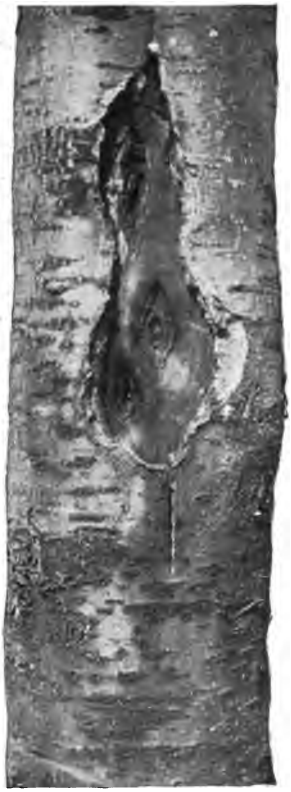
During recent years several kinds of cankers occurring especially upon apple and pear trees have been described and figured in bulletins from different experiment stations in this country. By careful inoculation experiments these various cankers have been shown to be due to different species of either fungi or bacteria. Growers very generally even at the present time attribute such injuries to "sun scald" or "freezing." Lack of knowledge of the nature of fungous and bacterial growths, together with the ease with which responsibility may be shifted upon the weather, has made this opinion the common and natural one. Not only have experiment station workers shown that these injuries are usually due to the attacks of living organisms rather than to the results of weather conditions, but they have demonstrated that the different forms of these cankers are due to distinctly different organisms.

The term "canker" then has come to be a very general one and is applied to diseases which cause the death of definite areas of bark on the limbs and bodies of trees. At least six distinct canker diseases of apple and pear trees have been described and figured in recent years. Each of these cankers have been proven to be due to distinctly different kinds of fungi. In this paper, however, we shall deal with a canker disease, not caused by a fungus and differing strikingly from those already mentioned. To this disease I have given the name of blight canker.

THE DISTINGUISHING CHARACTERS AND APPEARANCE OF THE CANKER.

The blight canker while it may occur on trees of almost any age is most destructive on young trees just coming into bearing, trees from 8 to 15 years old. Old trees weakened by age and neglect may suffer seriously from its attacks and the dead limbs protruding here and there from the green foliage in old orchards are often to be attributed to the ravages of this canker.

In young trees with smooth bark the cankers are easily detected even in their first stages. They appear as *discolored* and *somewhat shrunken areas,* the margin along the advancing front being usually slightly raised or blistered. The tissue in actively spreading cankers is of a darker green than the healthy bark and is very watery or sappy. On damp cloudy days drops of a milky, sticky fluid exude from the cankered tissues through



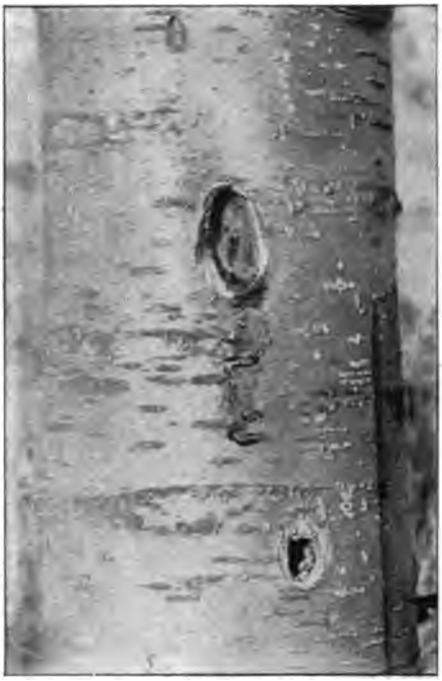


FIG. 4—Typical pit cankers in the body of a tree from which the diseased bark has dropped out. The upper one is exuding sap,—"bleeding."

FIG. 3—Cankers in body of tree resulting from the renewal of activity season after season. Observe that these started from small pit cankers which partially healed each season. The disease the following season destroyed all the bark growth, leaving only the little bit of wood formed in the callus. This still persists.

the lenticles or pores in the bark. After a short time the diseased tissue begins to turn brown and dry out. Unless in a very active state of progress the margins are quite distinct, marked by a crack where, in drying, the diseased tissue has separated from the healthy bark. The older cankers are brown, somewhat darker than the healthy bark. They are distinctly sunken. The surface is smooth, never checked or roughened or beset with pustules or pimples, except in the old cankers where after a time rot fungi gain entrance and thriving in the already dead tissue produce their fruit bodies on the surface. The progress of the spreading canker depends largely upon the continuation of favorable weather conditions, which seems to be a *humid atmosphere and cloudy days.* With the return of bright, sunny weather the active spread of the canker is checked abruptly, often to be resumed again with the return of favorable conditions. This checking and renewing of activity sometimes results in large cankers with concentrically arranged cracks within the cankered area. This renewal of activity may take place during the same season or the canker may partially heal over to spread anew the following year. A large per cent of the cankers are active during but one season. There are always some, however, in which the disease is perennial, living through the winter to become active again the following spring, spreading and enlarging the original limits of the cankered area. These "hold over" cankers, as they are called, are the dangerous ones. They are the source of infection for the following year. The diseased bark is usually killed to the wood, to which it clings tenaceously the first season. It gradually decays, however, and falls out, leaving the wood bare and exposed. In small cankers, the cone of diseased bark may be quickly forced out by the rapidly forming calluses which heal and close the canker wound. In some cases the canker is superficial, never reaching the cambium except perhaps in a limited area at the point of infection. Such wounds heal quickly beneath the dead bark which clings to the tree as a sort of scab.

The cankers vary in size from half an inch in diameter to as much as a foot or more in length and several inches across. On healthy, vigorous trees they are small and more or less circular in outline. They form funnel-shaped wounds with the small end at the cambium. These I have designated as "pit cankers." Often the dead bark remains as a sort of lid to the pit but it is easily removed with the finger or a knife blade. I have seen young trees with limbs and bodies literally covered with these

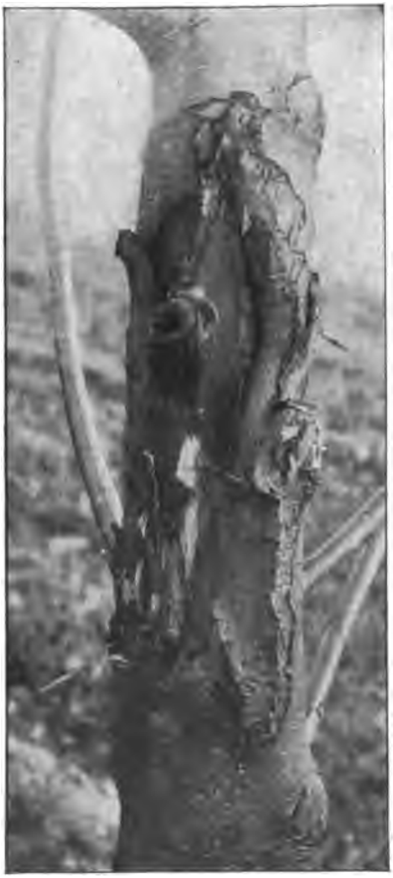


FIG. 5—Large body canker resulting from successive seasonal attacks of the disease. Originated at the pruned stub.

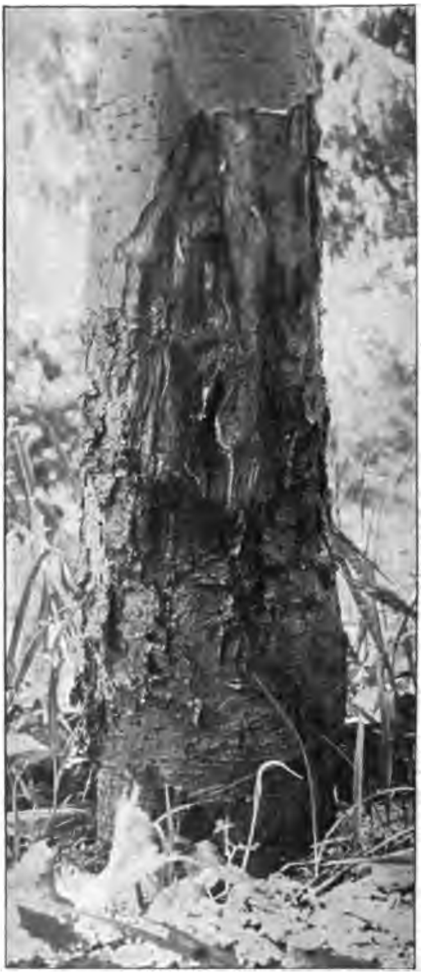


FIG. 6—Large body canker near base of tree, often referred to as "collar rot." The tree has made repeated attempts to heal this wound,

pit cankers in all stages of healing over. Aside from affording an entrance to rot fungi such cankers unless they enlarge do not seem to seriously affect the health of the tree. In many cases these pit cankers do not heal properly or at all and the disease spreading the same or the following season forms the large and dangerous 'limb'' or ''body cankers.''

''Crotch cankers'' usually appear in the crotches where the main limbs arise from the body but may also appear in the secondary crotches well up in the tree. In general characters they are similar to the limb and body cankers. Owing to their peculiar position water is retained more readily in the dead bark, thus affording the very best of conditions for the entrance and growth of rot fungi. These find easier access to the heart wood at the crotch than on the limbs. It was observed that these crotch cankers heal much less readily and successfully than do the limb and body cankers. Crotch cankers unless promptly attended to means the almost certain destruction of the trees.

The large cankers at the bases of young trees frequently referred to by growers as ''collar rot'' are in many cases very probably due to the same cause as that of the cankers on the upper parts of the tree.

HOW THE DISEASE AFFECTS THE TREE.

The effect of the blight canker upon the tree is to lower its vitality to a greater or less degree by cutting off the food supply to the roots and thus indirectly reducing the flow of sap to the branches and leaves. In other words, it acts the same as ''girdling.'' The ''collar rot'' and ''crotch cankers'' seem to be the most fatal to the tree. The effects of the canker are first evidenced in the foliage. If there is a large body canker the entire tree may show the effects of the trouble. More often the first symptom noted by the grower is the peculiar appearance of the foliage on one or more of the limbs. Either these branches fail to leaf out at all in the spring, or if they do the leaves never fully expand but remain undersized and curled or inrolled. They never take on the dark green color of healthy foliage, remaining pale and gray. Growers often refer to such trees as having "mouse ear" leaves. As the season advances and the cankers spread, the leaves often die and dry up on the

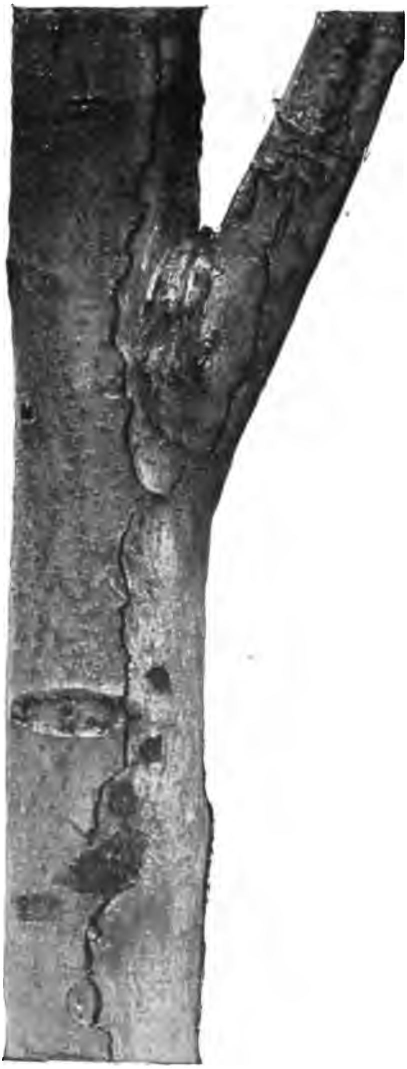


FIG. 7—Canker on pear tree resulting from inoculation with bacteria from active canker on apple tree.

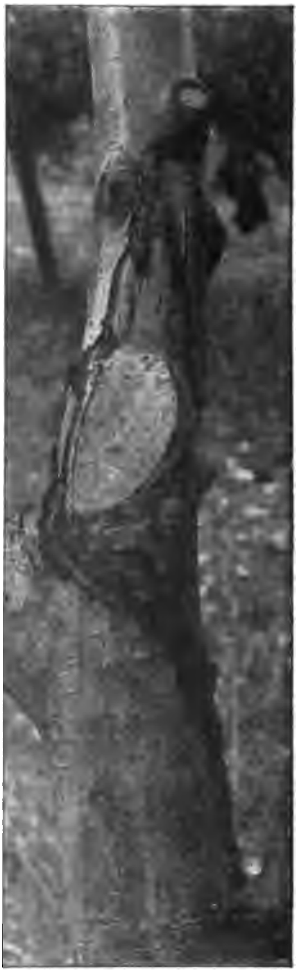


FIG. 8—Pruned stub canker that has spread down side of limb during early spring of second year. Diseased tissue cleaned away, treated with corrosive sublimate and painted. Good calluses formed. Canker ceased to spread.

branches. Sometimes badly affected trees will pull through until autumn or even live for two or three seasons. Such trees have scanty foliage, blossom profusely and frequently set a heavy crop of fruit. This fruit falls prematurely or is small and inferior in quality.

Such affected limbs and trees, as if in anticipation of their approaching death, seem to devote their expiring energy to one grand and final effort to reproduce themselves. As already stated, where the trees are strong and vigorous they frequently succeed in promptly healing the canker wounds. The dead bark of the canker makes, however, an excellent infection court for the entrance into the tree of "heart rot" and other decay inducing fungi. Moisture so necessary to the germination and growth of the spores of fungi, is retained for a considerable time in the dead tissue. This is more especially true of crotch cankers. No doubt these rot fungi are often to blame for the final death of the tree. The heart wood of badly affected limbs and trees is commonly found to be soft and rotten with only a thin rim of sound sap wood surrounding it.

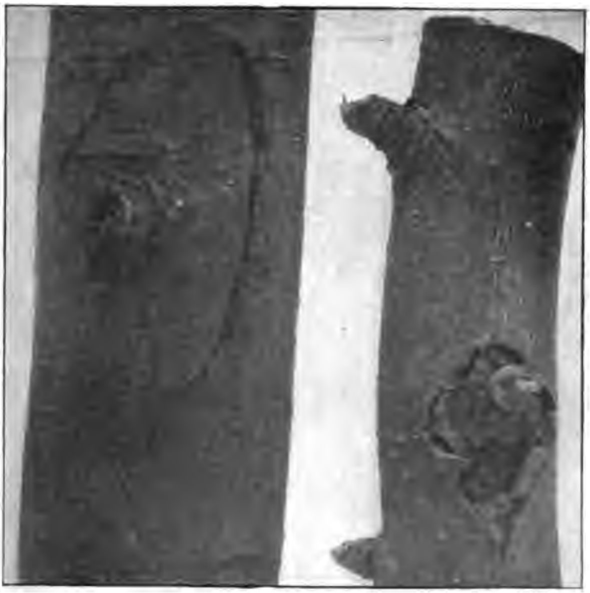


FIG. 9—Canker on limbs of apple which originated through blighted spurs.

THE CAUSE OF THE CANKER.

A microscopic examination of the viscid milky drops that exude from freshly cankered surfaces on moist, cloudy days will show them to be composed almost entirely of minute rod-shaped bacteria. The diseased tissue within the bark will also be found to be alive with these minute plants. By their rapid growth and multiplication within the cells of the bark they cause its death. They are not carried along in the sap but slowly work their way from cell to cell. When the canker dries down they die and disappear so that examination of the tissue of old cankers does not show them. That they are the direct cause of the disease was proven in the following manner: Bacteria from the cankered tissue was introduced into the bark on the body of a healthy apple tree and also into the bark of a healthy

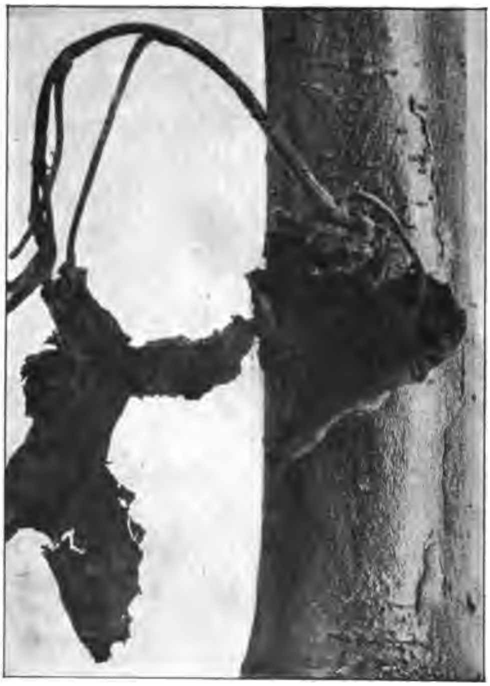


Fig. 10—Recently blighted shoot on limb of Greening apple tree with well marked active canker about its base.

pear tree, with the result that typical cankers appeared in both cases. Blossoms and growing twigs of both pears and apples were also inoculated with bacteria from this same canker. These nearly all developed good cases of blight in about ten days, while twigs and blossoms punctured with a sterile needle gave no infection. This last experiment was twice repeated during the summer with pure cultures of the bacteria from the apple tree canker. The blight resulted in practically every case. Young fruits of both the pear and apple were also inoculated and gave well developed cases of the disease. By a comparative study in various culture media of the bacteria from cankers, twigs and fruits of both pear and apple obtained from different orchards about Ithaca the organism of the canker was shown to be identical with that of the well-known "fire blight" of the pear and "twig blight" of the apple, Bacillus amylovorous.

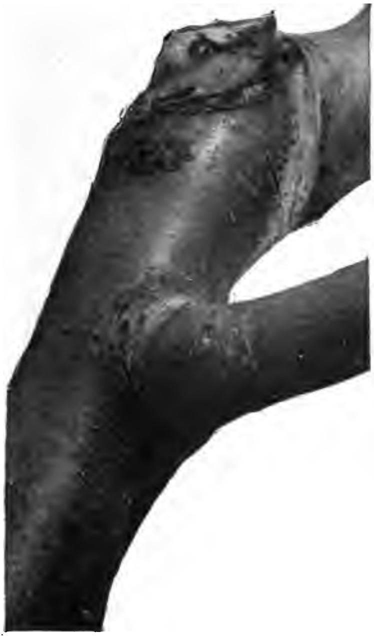


Fig. 11—Pruned stub canker. Infected at time of pruning, probably by the saw. Note the color of dead bark.

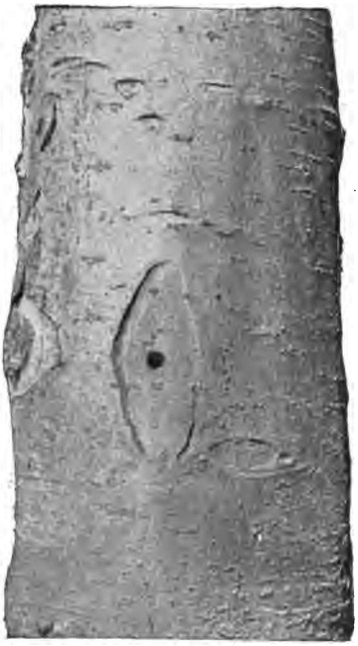


Fig. 12—Canker formed about the mouth of the burrow of a borer near base of an apple tree.

HOW TREES BECOME INFECTED.

Only those ways of infection which personal observation has discovered are here recorded. No doubt the bacteria enter the bark in still other ways than those I have observed.

Early in my investigation I came to the conclusion that the bacteria frequently get into the bark of the limbs and body by way of *short spurs* and *watersprouts.* The opinion was fully confirmed later in the season. Twig blight became very prevalent during July and August, especially in the region about Ithaca, N. Y. It was then an easy matter to find blighted spurs and watersprouts with active cankers about their bases. Where these watersprouts grew out from the trunks as is often the case in young trees, typical body cankers were formed. The infection of the sprout itself is generally attributed to the work of insects which after visiting freshly cankered spots or blighted twigs introduce the bacteria into the succulent tissues of the rapidly growing healthy shoots. The blighted watersprout soon dries up and falls away, leaving often a very indefinite scar in the cankered area so that the following season it is usually impossible to tell with certainty the manner of infection. Observation of a large number of trees, during the past season, convinces me that the blighting of adventitious shoots on trunk and limbs is responsible for a majority of the cankers in such locations. A number of cankers were produced in this way by artificial inoculation.

Another source of infection was found to be the *pruning knife.* Along one side of an orchard of some 350 trees which was under observation throughout the season, it was early noticed that the pruned stubs of 1904, especially, showed collars of dead bark often two or three inches in width. Instead of forming a callous and healing over the wound, as would normally occur, the tissue had died and shriveled up but still clung to the stub. In most cases the bacteria which had caused the death of the bark had died out the first season. In a few instances, however, the canker was observed to be active early in the spring, extending down the side of the adjoining limb. Two badly diseased trees on this side of the orchard seem to have been the source of infection. Owing to their diseased condition they had been severely pruned the previous season and very probably the knife or saw had carried the bacteria to the healthy trees. Flies which were observed to constantly follow the pruner to suck up exuding sap may have been the direct agents in many cases in transferring the bacteria. The knife itself may convey the disease, as is shown by the following incident: While making inoculations into the body of an apple tree on the station grounds, I had occasion to remove from near the base a large sprout of several years' growth. This I did with my knife which I had but shortly before used to cut bark from a fresh canker. A typical canker soon developed about this pruned stub.

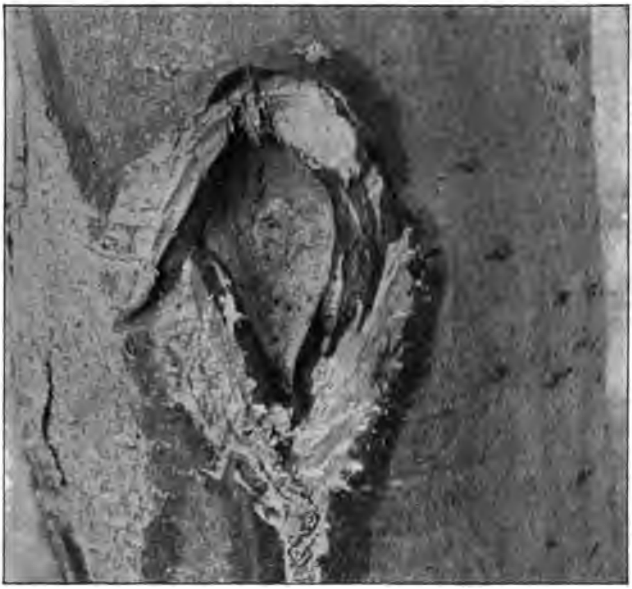


Fig. 13—Body canker cleaned out, treated and painted about eight weeks after treatment. Good healthy calluses formed, which with proper care will completely heal this wound.

Of a similar nature are infections that occur through *wounds or bruises on the limbs and bodies of trees.* These wounds, commonly known as "barking," may be made by careless workmen when plowing or working about the trees or from the gnawing of animals, one of the worst of which in New York is the woodchuck. A large per cent of such wounds heal over eventually, but frequently through the agency of insects or other other means these wounds serve as infection courts for the canker bacillus. An interesting case of wound infection came under my observation this season. In cutting a cankered branch from a tree I accidently "barked" a healthy limb with the cut end of the diseased branch. The tree was not again visited until some weeks later, when a large and actively spreading canker was found to have developed about the abrasion. The bacteria were found in abundance in the diseased tissue and pure cultures obtained.

The *wounds or punctures of insects* seem to be directly responsible for some of the infections. Occasionally cankers on the bodies of trees cannot be attributed to infection through blighted shoots. In some cases these cankers have been traced directly to the wounds made by insects. It is probable that many of the cankers at the base of young trees originated in wounds made by borers. One undoubted case of this kind came under my observation last summer. The bacteria are probably carried to these wounds by flies or other insects which visit these places to feed on the exuding sap and excrement. The infecting agents in the case of crotch cankers have not as yet been definitely located. It seems likely that insects are here again responsible.

I have found them repeatedly hiding in the crevices of the dead bark that accumulates in the crotches, and one species seems to feed to some extent on the living tissues in such places. I have also observed this same species feeding on the exuding sap of cankered limbs and stubs. That it may carry the bacteria to the crotches seems obvious. Besides this many of the crotches are of such a form that they readily retain moisture and thus afford the best of conditions for bacterial growth.

As a general deduction, then, it may be stated that infection occurs only through a wound of some sort. Moreover, the infection court must be of such a nature that it will not dry out quickly. An abundance of moisture is known to be necessary to the rapid growth and development of the blight organism. This peculiarity accounts for the ease with which growing shoots are affected. Where the diseased tissue of an active canker was at once cut out and the wound exposed to the drying heat of the sun without any other treatment, the canker ceased to spread and the place healed rapidly.

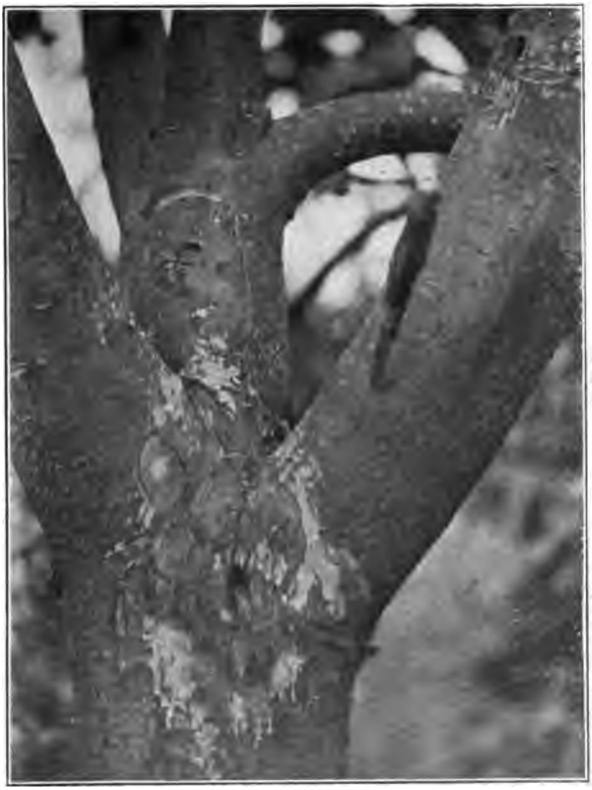


FIG. 14—Crotch cankers, Wausau Orchard. Treated July, 1906, but work not thoroughly done. Note the canker extending on central branch. The branch on right is also affected for several inches. Photo, July 1907.

TREATMENT THAT PROMISES BEST RESULTS.

Although the work of the past season has been devoted largely to a study of the various manifestations of the disease, its cause and distribution, still some attention has been given to the means of combating it. *Prevention* rather than *cure* is one of the axioms of plant pathology. In most cases the curing of a diseased plant is impossible or its value does not warrant the effort required to save it. However, in the case of trees just coming into bearing it seemed that if possible some means of saving them should be worked out. Several things were accordingly tried, but the one that so far gives most promise of definite results is to *cut out the cankers.* With a sharp knife remove all the diseased tissue, swab out the wound with a solution of corrosive sublimate (one tablet to one pint of water) or with a solution of copper sulphate, 1 oz. to 2 gallons water, and when dry paint over thoroughly with some heavy lead paint. This should be done early in the season as soon as the cankers are discovered, for two reasons: 1st, the spreading of the canker and its consequent damage to the tree is stopped; and 2nd, the wound is thus given a long period in which to heal. The painting should be repeated again toward the close of the season and again the next year or until the wound has completely healed. This prevents a second infection or the entrance of rot fungi. A bi-monthly inspection of every tree should be made and all cankers carefully cut out and treated as soon as they appear. Cankered trees so treated early in the spring of 1905 have formed good calluses and are fast healing the wounds.

PREVENTIVE MEASURES.

It is scarcely necessary to point out that every precaution should be taken to prevent bruises or injuries of every sort, since these make excellent infection courts for the entrance of the bacteria.

All dead limbs and trees should be promptly removed from the orchard and *burned.* Old pear trees in the neighborhood of young apple orchards are often a constant source of infection and unless kept absolutely free of the blight should be removed. A neighbor careless in respect to blight in his pear trees is a dangerous one.

Cut out and burn every trace of twig blight from both pear and apple trees as soon as it is detected.

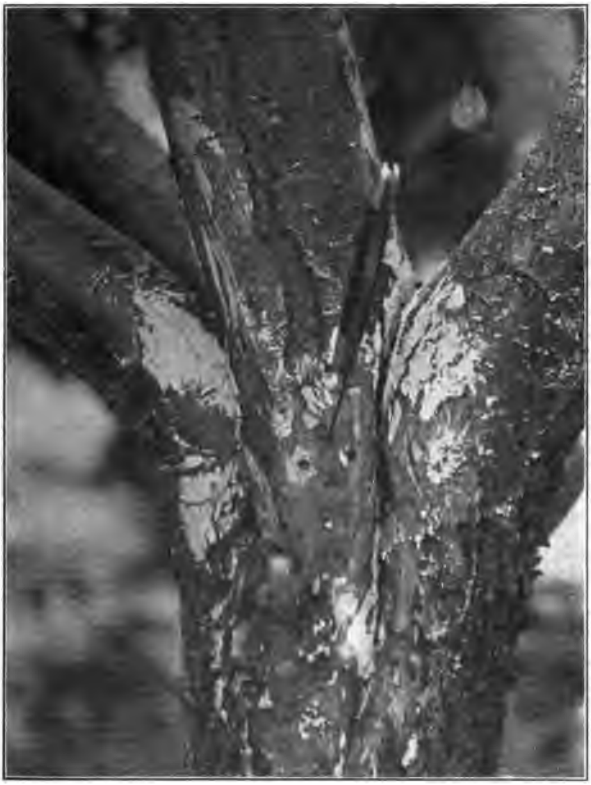


FIG. 15—Crotch canker, Wausau Orchard. Treated July 1906; photo, July 1907. Treatment thorough and effective. Canker completely checked and tree saved.

When pruning, treat all cut surfaces with the corrosive sublimate or copper sulphate solution and keep them painted until healed. Treat all accidental wounds in the same way.

Keep the body and main limbs of the tree free of watersprouts throughout the summer.

In planting, select trees with open or spreading crotches.

Avoid excessive fertilizing with nitrogenous manures. Apply some form of phosphoric acid to ripen new growths.

The planting of varieties known to be more or less resistant to this disease is to be recommended. The Wolf River and Talman Sweet appear to be of this sort, while Baldwins and Ben Davis suffer most severely. Desirable non-resistant varieties may be top grafted on to resistant stocks.

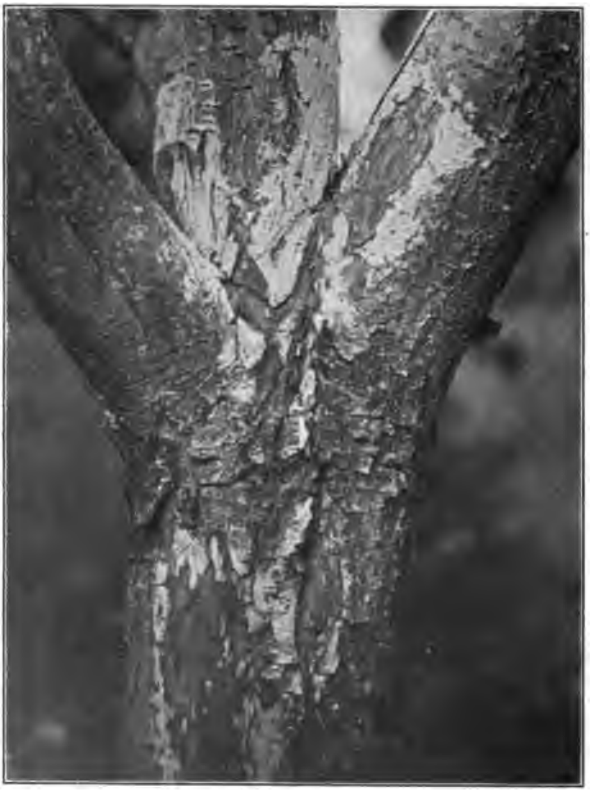


Fig. 16—Results of timely and thorough treatment. Similar to Fig. 15.

CONCLUSIONS.

Injuries caused by blight canker are often ascribed to "sunscald" and "winter-killing."

Blight canker is most often found on young trees, 8 to 15 years old.

Indicated, in most cases, by discolored and distinctly sunken areas of bark.

When active, cankers exude sticky fluid on warm and cloudy days.

Vary in size from one-half inch in diameter to a foot or more in length.

Frequently found in crotches.

Cuts off food supply; girdles branch or trunk.

Caused by same organism that causes fire blight of pear and twig blight of apple.

Trunks and crotches may be infected from: watersprouts, pruning knife; punctures of insects; "barking."

Treatment.—Cut out all cankered tissues, disinfect with corrosive sublimate or copper sulfate and cover wounds with paint.

Addenda

F. CRANEFIELD.

In the spring of 1906 treatement was begun of the affected trees in the Wausau orchard.

It was found that about 100 of the trees were too far gone to warrant treatment and these were removed and the remainder treated as recommended in this bulletin. All cankers discovered were cut out, the wounds scraped clean, disinfected and painted. Pruning knives and gouge chisels were used.

The expense for labor and material was a little over forty dollars.

Over 90 per cent of the affected trees recovered and the entire appearance of the orchard was changed. A few of the trees were so badly affected, over one-half of the circumference of the bark on the trunks being removed, that recovery was delayed. Some of these died the following season and others are slowly recovering.

Had every canker in the orchard been found and treated the disease would have been completely eradicated, for a time at least. Naturally, however, some escaped treatment and in oth-

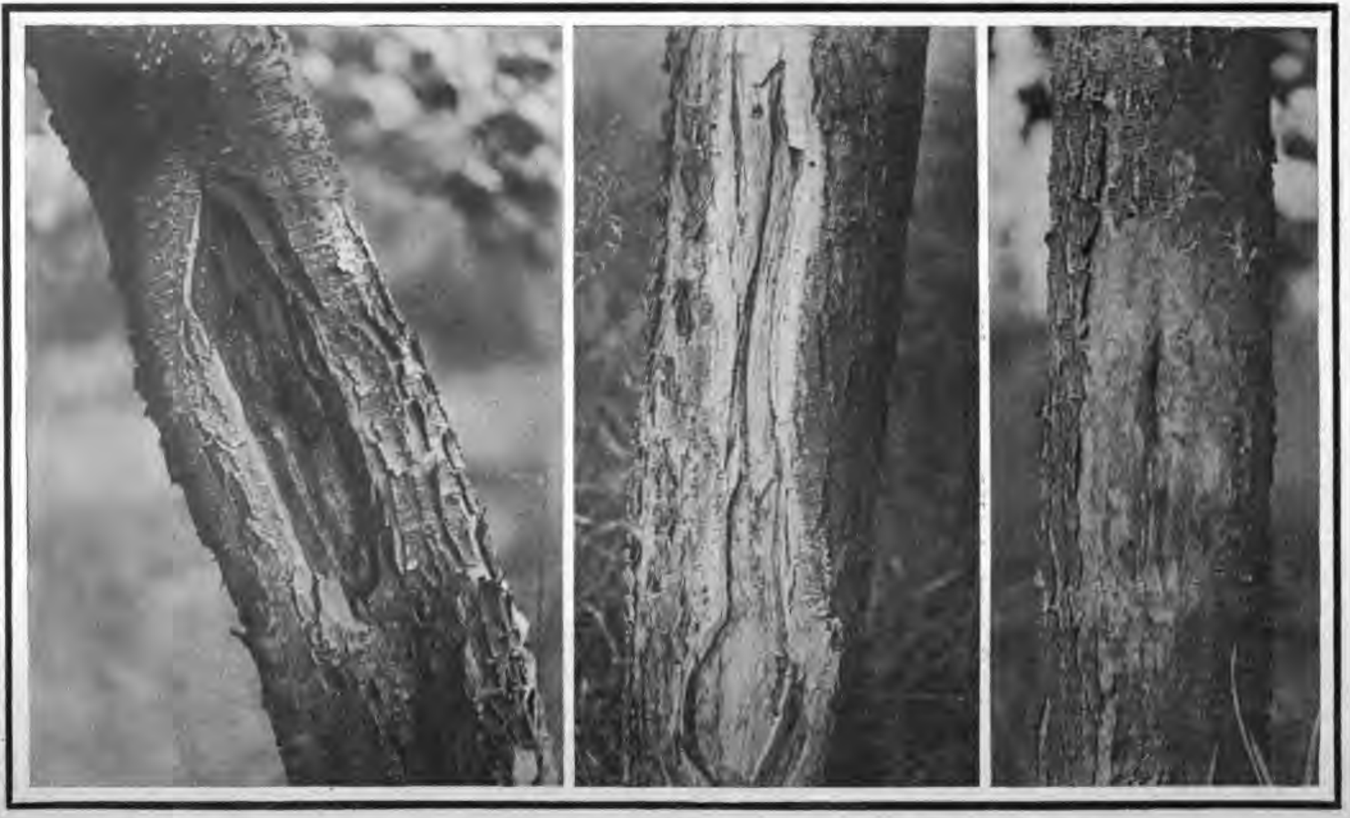


FIG. 17—Cankers on trunks of young trees, Wausau orchard, one year after treating. These cankers all undoubtedly originated from sap sprouts.

ers the cutting was not severe enough, a little of the affected bark being left to extend the canker. A case of this kind is shown in Fig. —.

When the treatment was thorough the wound began to heal at once, the new bark completely closing the smaller wounds by the end of the season. This caution should then be repeated; cut out *all* of the diseased tissues. Do not fail to cut to the live cambium, as the wound will soon heal if all of the canker is removed.

The orchard was gone over carefully later in the season and again in the spring of 1907. On the whole the effect of the treatment was remarkable and the orchard probably saved from destruction, for it is but reasonable to assume from the general appearance as a whole and the rapid progress of the disease in 1905 that two or three years more would have sufficed to kill most of the trees.

Observations in 1907 showed plainly that the work must be kept up every season, as many new crotch and pit cankers were found on trees treated in 1906.

The kinds most affected in the Wausau orchard are: Northwestern Greening, Longfield, Wealthy, Duchess, Peerless, Newell, Repka, and Hoadley, about in the order named.

The following were but little affected: McMahon, Patten Greening, Malinda, Wolf River, Okabena, and Dominion Winter.

Not a single canker was found on any of the 38 Hibernal trees.

The lesson in this orchard has been somewhat expensive in loss of trees, etc., but may prove very valuable if it results in calling the attention of even a small portion of those who have young apple trees to this most insidious and dangerous of orchard diseases.

WISCONSIN

State Horticultural Society

BULLETIN NO. 13

SPRAYING

(A Revision of Bulletin No. 4, Wisconsin State Horticultural Society.)

MADISON, WIS., APRIL, 1908

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Introduction

This bulletin is divided into two parts which may be called the "How" and "Why" of spraying. In the first part will be found formulas and suggestions for their preparation. This is the "How."

In the second part will be found brief discussions of the reasons for spraying with partial descriptions of the common insects and diseases affecting tree fruits in Wisconsin. There has been no attempt to make this part a complete manual of spraying but rather to give only enough to create an appetite for more. Those who wish to pursue the subject further are referrred to the following books:

The Spraying of Plants, Lodeman, The Macmillan Co., N. Y.

Spraying Crops; Insects and Insecticides; Fungi and Fungicides, all by Weed and published by the Orange Judd Co., of New York.

PART I.

FORMULAS

INSECTICIDES.

> **"Any substance which is used to destroy or repel insects may be termed an insecticide; and any substance which destroys fungi, or which prevents their injurious growth on vegetation, a fungicide. No substance, so far as known, will answer both purposes equally well."—Lodeman.**

No extended list of formulas will be given in the following pages. In fact, out of the long list of remedies published from time to time but two insecticides and one fungicide are now recognized as standard remedies, viz., an arsenical poison for biting insects, kerosene emulsion for sucking insects and some form of copper for fungi.

INSECTICIDES.

(For biting insects.)

PARIS GREEN.

Paris green	1 to 2 lbs.
Fresh (unslaked) lime	1 lb.
Water	200 gallons

Paris green is heavier than water and the mixture must be kept in constant motion during spraying operations to prevent settling.

It is often adulterated.

Gypsum and slaked lime are two adulterants commonly used.

Pure Paris green dissolves without sediment in ammonia, the adulterant will not. This affords a simple test for purity.

Paris green if used on growing plants greatly in excess of the above formula may injure the foliage. The addition of the lime overcomes the caustic properties and renders it safe under all conditions.

Dry Paris green may be used pure if applied in small quantities. Different "Dry powder guns" have been invented for this purpose.

A remedy for the potato beetle, codling moth and other biting insects. Commonly used with Bordeaux mixture.

ARSENATE OF LEAD.

(A poison for biting insects.)

Formula.

Arsenate of lead	2 to 3 lbs.
Water	50 gallons

Arsenate of lead is a combination of white arsenic, sugar of lead and sal soda. It may be prepared by combining these materials in proper proportion, but the process involves considerable labor and danger, as the ingredients must be combined by boiling. Several firms now offer this valuable insecticide prepared ready for use, among them:

The Bowker Insecticide Co., Boston, Mass.; The Merrimac Chemical Co., Boston, Mass., and The Grasselli Chemical Co., Cleveland O., branch office Milwaukee.

Arsenate of lead is less liable to injure foliage than Paris green.

It remains longer in suspension.

It adheres better to foliage.

It may be used for any purpose for which Paris green is employed in liquid sprays. Arsenate of lead has been used in spraying the Wausau orchard the past four seasons and with perfect satisfaction.

WHITE HELLEBORE.

(For biting insects.)

Powdered white hellebore is commonly employed to destroy currant and cabbage worms and on fruits and vegetables where more poisonous substances cannot be used with safety.

Formula.

White hellebore	1 oz.
Water	2 to 3 gallons

It may also be used dry either alone or mixed with flour, land plaster, soot, etc.

White hellebore is scarcely poisonous to the higher animals and may be used freely on fruits and vegetables at any stage of maturity.

KEROSENE EMULSION.

(For sucking insects.)

Used only to destroy sucking insects. It must be applied to the insects and cannot be used as a preventive.

This is the standard remedy for sucking insects.

Formula.

Dissolve 1 lb. hard soap in 2 gallons of boiling water.

While hot add 2 quarts kerosene.

Churn or shake the mixture while hot for 5 to 10 minutes or until it assumes a creamy consistency.

Add 6 gallons of water before using.

Another plan consists in using sour milk instead of the soap water, the object in either case being to hold the kerosene in suspension while it is applied to the insects.

The most approved method of applying kerosene is by means of a special pump designed to mix kerosene and water. These pumps are made by different firms in various sizes from a hand pump or syringe which may be had for 75 cents, to a barrel pump costing $20.00. This is the cheapest, most agreeable and by all means the best method of applying kerosene.

FUNGICIDES.

The control of fungous diseases is accomplished by the use of some form of copper salts, usually copper sulfate or copper carbonate.

The former, known also as blue-stone, blue vitriol, etc., is generally recognized as more efficient than the latter. When purchased in large quantities it is also cheaper.

Copper sulfate may be used on dormant plants when dissolved in water at the rate of 2 lbs. to 50 gallons of water, but *this solution must not be used on growing plants.*

Copper sulfate in combination with fresh lime forms the standard and well known fungicide

BORDEAUX MIXTURE.

Various formulas are quoted, but the following is now accepted as safe and reliable:

Copper sulfate	5 lbs.
Fresh lime	5 lbs.
Water	50 gallons

In general terms, the copper sulfate should be dissolved in one-half of the water, the lime slaked in the remainder and the two solutions poured together. This results in a chemical action giving rise to a new substance preserving the fungicidal properties of the copper sulfate and if properly made will not injure foliage.

Bordeaux mixture is used as a preventive of apple scab, asparagus rust, grape mildew, mildew on roses and other plants, potato blight and rot, shot-hole fungus on plum and cherry and other fungous diseases.

Helpful Hints in Making Bordeaux Mixture.

(1) Have on hand three barrels and two pails (wood or fiber.)

(2) Twenty-five gallons of water in each of two of the barrels.

(3) Dissolve 5 pounds of copper sulfate in one barrel by suspending in a coarse burlap as near the surface of the water as possible; in this way it will dissolve in a few minutes, while if allowed to settle to the bottom it would require several hours to dissolve.

(4) Place the lime in a pail and slake by adding water slowly until a paste is formed. (The lime for Bordeaux mixture should be slaked exactly as for building purposes.)

(5) Pour this lime paste into the second barrel and stir thoroughly.

(6) Now pour into the third (empty) barrel first a pailful of the copper sulfate solution then a pailful of the lime water, or better, let two persons work at the job, pouring together.

(8) The resultant mixture should be of an intense blue color. If any tinge of green appears it is not good Bordeaux mixture.

(9) The lime-water should be strained to remove the coarse particles which serve to clog the nozzles in spraying.

(10) Sufficient lime must be used to combine with all of the sulfate or harm will result. The formula given above provides an excess, but such excess is preferable to a slight deficiency. Use all of the lime water.

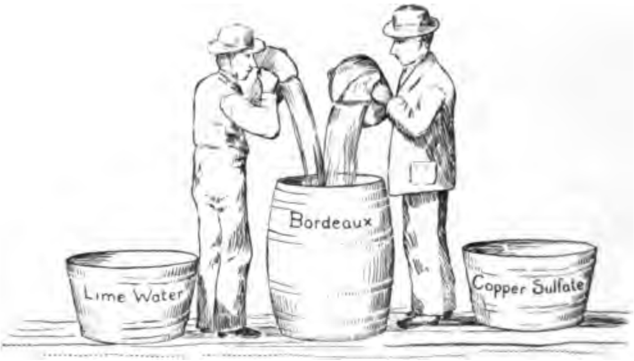

FIG. 1. Illustrating method of making Bordeaux mixture. Adapted from Farmers' Bulletin No. 38, U. S. Dept. of Agr. B. T. Galloway, author.

(11) Test the mixture. It is always advisable to test every barrel of the mixture before using to detect the presence of any free or uncombined copper which might injure foliage.

Test No. I.

Dip a bright, clean steel knife blade into the prepared Bordeaux mixture; if any, even the slightest, deposit of copper appears on the blade after a few moments' exposure to the air it is an indication that more lime is needed.

The knife blade should be thoroughly whetted before using for a second test. While this is simple and fairly reliable,

Test No. II,

or the ferro-cyanide of potassium test is more accurate.

Ferro-cyanide of potassium may be purchased at any drug store.

Place a small quantity (1 oz.) in a bottle and add water slowly until nearly all of the yellow crystals are dissolved. Stir the Bordeaux thoroughly and dip out a few ounces in a saucer. Add a few drops of the ferro-cyanide solution; if any brown discoloration appears it is an indication that more lime is needed. This is a delicate and reliable test.

The ferro-cyanide is a violent poison and should be labeled as such.

Three Things to Avoid in Making Bordeaux Mixture.

(1) Do not use iron or steel vessels for the sulfate or Bordeaux. Not only will these be corroded but the chemical action resulting from continued contact may injuriously affect the mixture. Tinned or galvanized pails are unsafe, as the zinc or tin coating is apt to be imperfect. Use only wood, copper, earthenware or glass.

(2) Do not dissolve the sulfate and lime each in 2 to 4 gallons of water as formerly recommended and then mix the concentrated solutions; curdling will result and after dilution difficulty will be experienced in keeping the lime and water in suspension.

(3) Do not fail to stir the ingredients while mixing and the resultant mixture when spraying. If allowed to settle the only portion possessing fungicidal value quickly settles.

Keeping Qualities of Bordeaux Mixture.

Reports are on record of the use of Bordeaux mivture several days after mixing with no injurious results, but it is generally agreed that for perfect safety it should be used only when fresh. The expense of a barrel of the mixture is too slight and the chances of injury too great to warrant using Bordeaux that has been made more than 24 hours.

The Use of Stock Solutions in Preparing Bordeaux Mixture.

If more than one barrel of Bordeaux is required much time may be saved by using stock solutions.

Dissolve 50 lbs., for example, of copper sulfate in 25 gallons of water by suspending in a coarse sack as advised above; slake 50 lbs. of lime in another vessel and dilute to 25 gallons; two and one-half gallons from each stock solution will then contain the requisite amount for one barrel of Bordeaux.

Such stock solution may be kept indefinitely if covered, otherwise the evaporation of water from the sulfate solution would result in a more concentrated mixture and the lime would deteriorate. The lime may be covered with water.

The Bordeaux should be tested when made from stock solutions as when made direct.

This method of using stock solutions is now employed in all extensive spraying operations. In some cases large elevated tanks are used, from which the solution may be drawn directly into the spray barrel or tank.

CARBONATE OF COPPER.

A substitute for Bordeaux mixture. (Used as a preventive of fungous diseases.)

Copper carbonate	3 oz.
Ammonia (22° Baume)	1 quart
Water	25 gallons

Dissolve the copper in the ammonia, which should first be diluted with 7 or 8 quarts of water, then dilute to 25 gallons with water.

The term "22° Baume" is a trade term used to indicate the strong ammonia of commerce.

Neither this nor any other definite formula is recognized as wholly safe.

It is better to add the carbonate to the ammonia, diluted with 7 or 8 volumes of water, until no more will be dissolved.

This solution must then be diluted at least 100 fold before using.

The advantages ascribed to this preparation over Bordeaux are as follows:

(a) It is a clear solution and will not discolor foliage, flowers or fruit and as a consequence may be used on ripening fruit.

(b) It is without sediment.

To offset this is the uncertainty as to the safety of the mixture unless prepared by one skilled in its preparation and the increased cost.

POTASSIUM SULPHIDE.

(Liver of Sulfur.)

For checking the spread of certain surface feeding fungi, as gooseberry mildew, grape mildew, rose mildew and many of the fungi which cause "damping" of young plants in the seed bed, potassium sulphide may be used to excellent advantage.

Formula.

Potassium sulphide	4 ounces
Water	10 gallons

The solution must be used as soon as made, as it quickly loses its strength.

Any unused portion of the potassium sulfide should be kept in a tightly corked bottle to prevent loss of strength.

COMBINING INSECTICIDES AND FUNGICIDES.

Either arsenate of lead or Paris green may be safely combined with Bordeaux mixture. In fact, in all orchard spraying operations it has come to be a common practice to add either Paris green or arsenate of lead to Bordeaux at every application. By this means biting insects and fungi are controlled at a single operation. No other fact is more important than this in spraying.

Other combinations than the above have been attempted, but with only slight success, as combining kerosene emulsion and Bordeaux; kerosene emulsion and Paris green, etc.

Neither may Paris green be safely used with the ammoniacal solution of copper carbonate. The caustic effects of this combination in some cases are supposed to result from the action of the ammonia in setting free arsenious acid.

SPRAYING MACHINERY.

The application of spray mixtures necessitates the use of some sort of force pump. Spray pumps and machinery may be divided as follows on the basis of efficiency:

(1) Syringes, atomizers or other like devices known as "hand" sprayers, used to spray house plants and small plants in the garden.

(2) Pumps or devices adapted for small gardens where a few currant bushes, small trees, etc., are grown.

(3) Pumps for general orchard and field work and the spraying of shade trees under 50 feet in height.

(4) Large pumps operated by steam or other power and adapted to any class of work, but designed especially for extensive orchard and park work.

The average Wisconsin farmer or orchardist will seek for a pump in either the second or third class.

In addition to these many machines adapted to special lines of work are offered for sale, as potato sprayers, etc.

(1) The cheapest and simplest of efficient pumps may be found in the first class, viz., "hand" sprayers or atomizers. These sell for 50 cents to $1.00 and some are very efficient little pumps. Their usefulness, however, is confined to a very narrow field on account of the limited capacity for fluids and the very short distance sprays can be thrown.

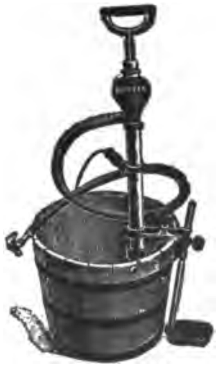

FIG. 2. Bucket spray pump.

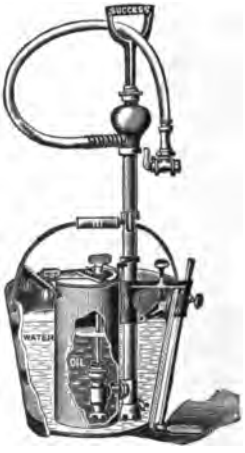

FIG. 3. Bucket pump with kerosene attachments. The "Success" pumps figured here are made by the Deming Co., Salem, Ohio.

(2) In this class are bucket and knapsack pumps and of these the bucket pump is to be preferred. Trees 10 to 15 feet in height may be sprayed with a bucket pump, also bushes, vines, etc. On some kinds a kerosene attachment is provided (Fig. 3), by means of which a mechanical mixture of kerosene and water may be applied to destroy sucking insects. Where

but a few young trees, bushes, etc., are to be sprayed a bucket pump will answer all purposes, but for extensive orchard work the time employed in refilling the bucket and in transporting the pump and mixture will more than offset the increased cost of a larger pump.

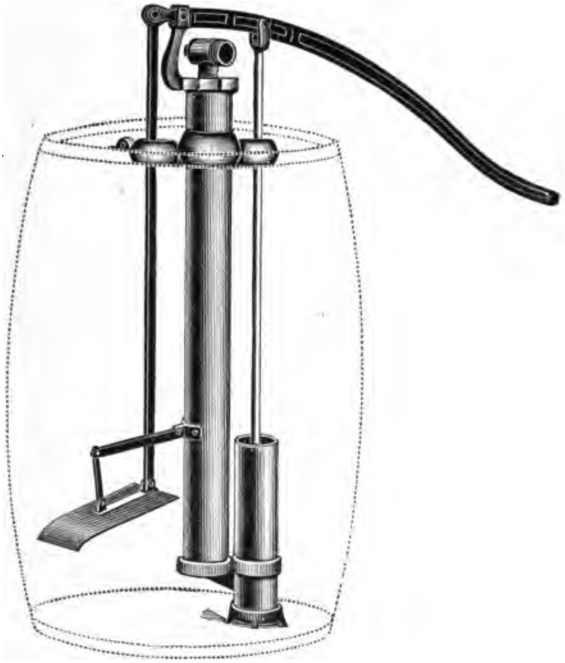

FIG. 4. The "Eclipse" barrel pump. Made by Morrill & Morley, Benton Harbor, Michigan. Other firms offering barrel pumps are as follows: Deming Co., Salem, Ohio; Spramotor Co., Buffalo, N. Y.; E. C. Brown & Co., Rochester, N. Y.; Goulds Mfg. Co., Seneca Falls, N. Y., and others.

(3) In this class are the various barrel pumps. These are designed to be fitted to an ordinary barrel (Fig. 4). This is the most popular kind of pump and it is probable that more of these are used than any other kind. While primarily designed to be used in a barrel, these may be fitted to a tank or other receptacle.

(4) The larger pumps are of interest mainly to park superintendents and owners of extensive orchards and need not be discussed here.

Prices.

Atomizers, 50 cents to $1.00.

Bucket pumps, $5.00 to $10.00.

Knapsack pumps, $5.00 to $15.00.

Barrel pumps, $10.00 to $25.00.

Power pumps, with engine, $150.00 to $500.00.

With pumps as with other machinery, the best is usually the cheapest in the end. Do not expect to get a serviceable pump for a low price. The best pumps have all working parts, valves, plungers and cylinder of brass. A pump that retails for three or four dollars may be of some service in washing windows or carriages, but is of slight value in spraying.

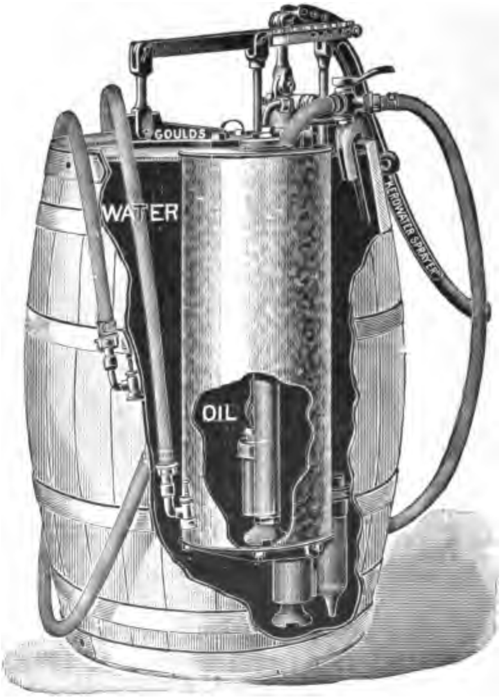

Fig. 4a. "Kerowaer" pump for spraying a mixture of kerosene and water.

Nozzles.

No matter how efficient the pump, good work cannot be accomplished without good nozzles. Many kinds are offered for sale, but of the multitude of forms but two types are in common use. These are represented by the "Bordeaux" and "Vermorel."

In the former the spray is formed by the fluid being forced against metal obstructions after it leaves the nozzle proper; in the latter a rotary motion is given it within the nozzle, breaking the fluid into extremely fine particles before it leaves the nozzle.

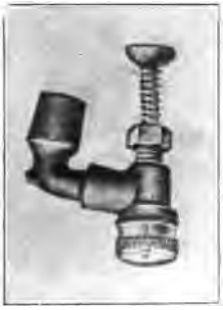

FIG. 5. Vermorel nozzle, single.

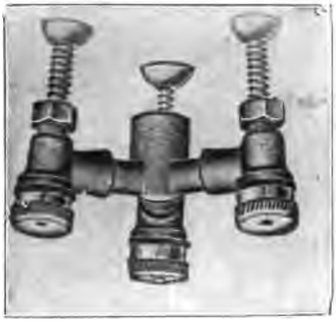

FIG. 6. Triple Vermorel.

The "Bordeaux" is adapted to use where the spray must be thrown several feet and in windy weather, but it cannot be graduated to produce as fine a spray as the "Vermorel" and is not, therefore, as economical of material as the latter. As nozzles are not a large item of expense in a spraying outfit it is well to have both kinds at hand.

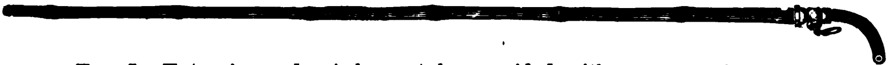

FIG. 7. Extension rod. A brass tube provided with a stop-cock and inserted within a bamboo pole.

Extension Rods.—In spraying large trees these are almost a necessity, as by means of a rod (Fig. 7) the spray may be directed to the inside of the tree, which could not be reached without it except with great loss of material.

A gallon measure made of copper is convenient but not a necessity.

A strainer of some sort is always needed to remove coarse particles of lime, etc. (Fig. 8). Straining through burlap is tedious and expensive.

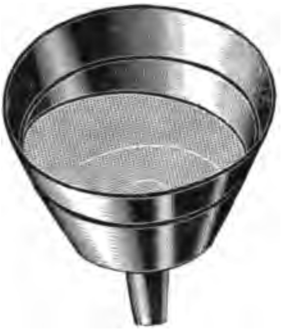

FIG. 8. Strainer.

A large copper funnel with a wire gauze strainer is better than burlap. Hose, nozzles, strainers, rods, etc., may be purchased of firms furnishing spray pumps.

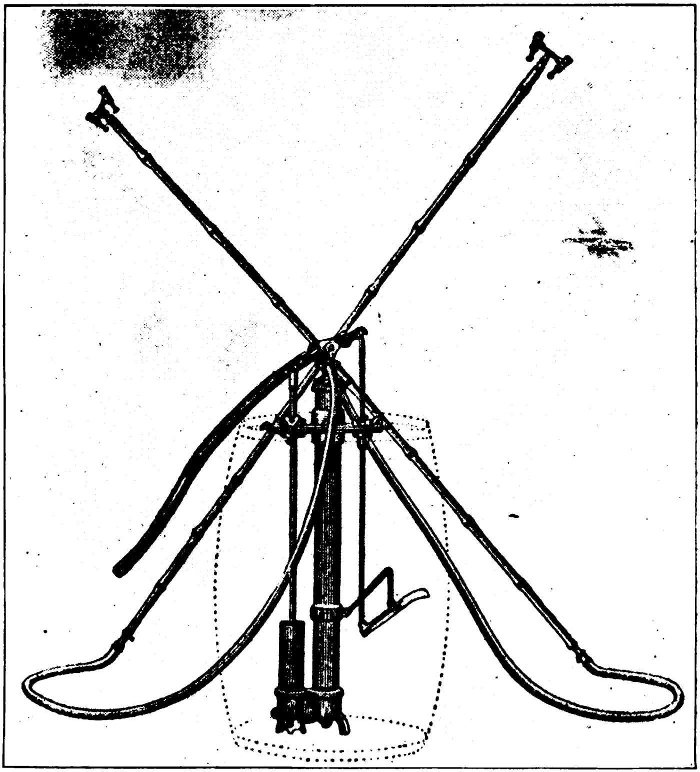

FIG. 9. An efficient pump equipped with two leads of hose, extension rods and Vermorel nozzles. This is the rig used with the 250 gallon tank shown in Fig. 15.

PART II.

SPRAYING

The successful culture of fruit demands a knowledge of tillage, fertilizing, pruning and the methods of combating insects and diseases.

It is mainly the lack or acquirement of knowledge concerning the enemies of the crop that distinguishes the successful from the unsucessful fruit-grower.

Animal husbandry demands skill in feeding and the general care of animals, but diseases as a rule are left to the veterinarian, but when our fruit trees are affected we must be our own doctor.

Trees may be totally neglected after planting and eventually give some sort of returns, but such practice is not worth while. If fruit trees and plants cannot be properly tended none should be planted, for the results will be disappointing.

Two classes of enemies attack fruit trees and plants, viz.: insects and fungous diseases; the application of substances, usually liquid, to the tree or plant for the purpose of preventing or destroying these constitutes spraying.

We spray to *destroy* insects and to *prevent* fungous diseases. Spraying is no longer an experiment. It is an established fact that intelligent and persistent spraying always pays.

The effects of spraying are cumulative. The effects of spraying last year and this year may result in an increased yield next year.

Spraying is not an exact science; we may and indeed should modify methods and formulas to suit conditions. The beginner need not fear that his trees will be ruined by lack of knowledge relating to the full and exact methods of preparing formulas, for only by gross carelessness or utter disregard of simple directions could such results occur.

Certain points, however, should always be observed. Three of these are so clearly stated by Lodeman* that they are given here verbatim.

"First, be on time. Make an application when it will do the most good, and never allow that time to pass if it can possibly be avoided. Every delay is of advantage to the parasite, and it will be used so well that in most cases the injury cannot be repaired. The destruction of one insect may mean the destruction of hundreds, and one application made at the right time may mean, and generally does mean, the protection of a plant against millions of spores of fungi which are endeavoring to gain a foothold. Be ready for action at a moment's notice, and when that moment comes, spray!

"Second, be thorough. When spraying a plant, spray it well. With a little care, a complete success may be obtained instead of only a partial one. When the work is finished, the grower should have the feeling that it is well done, and then no fear as to the result need be entertained. Spraying is not always pleasant work, and the temptation to slight it is often strong; but the operator will be rewarded just to the extent to which he has been painstaking, and to that extent only.

"Third, apply sprays intelligently. This is really the most important factor of the work, although good crops can be obtained without it, provided directions are followed. The first two points cannot be neglected without injury to the crop, but this one can be. The crop is in need of the applications only, but the grower should know the reasons for them, and should be in a position to modify his treatments so as to make them conform with the character of the insect or the disease which is being treated, and with the season. Every year and every day such knowledge will be of value. So many things are still unknown, and so many points still in dispute, that personal knowledge and judgment about individual cases are not only desirable, but very essential. Directions covering the majority of cases can be given, but now and then one will come up which seems to differ from all others, and it is then that this knowledge will prove most valuable."

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*The Spraying of Plants. Lodeman. P. 226. Published by the Macmillan Co., 66 Fifth Ave., N. Y. Copyrighted.

In order to derive the best results from spraying we need a knowledge of the life history of the insects and diseases commonly affecting our plants.

In a publication of this nature it is manifestly impossible to enter into a wide discussion of these subjects. Several excellent books have been published which present the subject in full. A perusal of one or more of these supplemented by close observation will be helpful.

An acquaintance with certain elementary facts, however, is essential to any intelligent work in spraying.

THE TRANSFORMATION OF AN INSECT.*

"To fight an insect intelligently one must know its life history. There are certain periods in its life when it is vulnearble and others when it is protected. This change of conditions is largely due to the fact that most insects in the course of their lives undergo a great many changes of form; they undergo a "*transformation.*" Mostly the various stages of this transformation look so different that if we did not know, we would set them down as different animals. Thus we have insects with a *complete "metamorphosis,"* which comprises four stages, and those with an incomplete metamorphosis with less stages. The stages of one of the higher insects with a complete metamorphosis being known, we can infer the corresponding stages of most of the lower forms.

As an illustration the four stages of one of the most destructive, and yet by most people little known, insects, the *codling-moth,* which in one stage is the "apple worm," are here placed in the form of a life cycle.

I. *The egg* is laid on the apple.

II. From the egg hatches the *caterpillar* or apple worm, which eats its way through the blossom end into the apple. *This is the only stage in which the insect grows.*

III. The caterpillar has changed to a *pupa, a resting stage,* under the bark of the tree.

IV. Out of the pupa emerges the *moth,* the *adult* insect. In this stage reproduction takes place and we begin our cycle over again with the egg.

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* Prepared by request, by C. E. Bues.

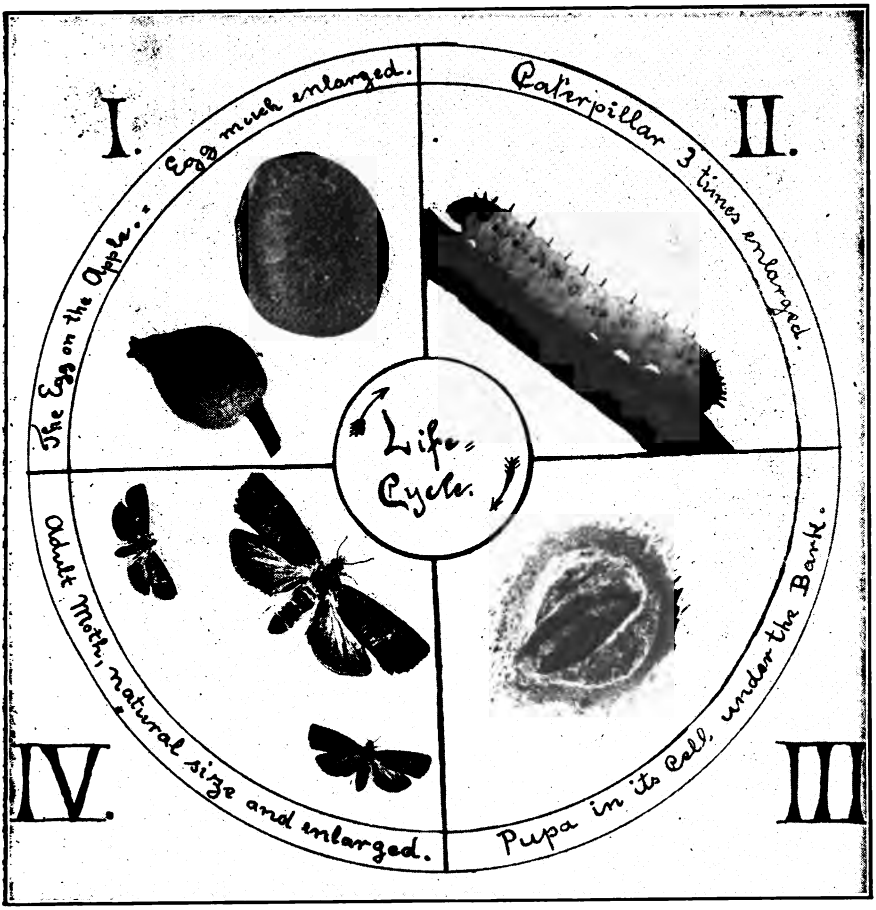
I.
II.
III
IV.
The Egg on the Apple. Egg much enlarged.
Caterpillar 3 times enlarged.
Pupa in its Cell, under the Bark.
Adult Moth, natural size and enlarged.
Life Cycle.

FIG. 10. Life cycle of codling-moth. Prepared by C. E. Bues from photographs furnished by Prof. M. V. Slingerland.

To these insects which go through these four stages belong the butterflies, beetles, bees and flies. Some insects lack the resting or pupa stage, and the young, when hatched, resemble the adult to some extent. These are insects with an *incomplete metamorphosis.*"

The insects affecting fruit may be divided for convenience into two classes, which are distinguished by their mode of feeding, viz., eating or chewing insects and sucking insects.

Eating insects consume the affected tissues, commonly the leaves, and thereby hinder the functions of the plant. Common examples are the potato "bug" or beetle; the currant worm which defoliates currant and gooseberry bushes twice in the season; the larva of the codling-moth, which causes wormy apples; the plum curculio; the tent caterpillar and others.

Insects of this class are destroyed by poisoning their food. The parts of the affected plants consumed are covered with a poisonous substance which is eaten with the plant tissues, causing death. Insects that eat only the foliage are easily destroyed and should cause no great concern. Usually a single application of Paris green or arsenate of lead is sufficient. Insects that attack the fruit are more difficult to control.

Sucking insects do not consume the external tissues of the plant but feed only on the sap. In order to accomplish this the insect thrusts its proboscis through the external coverings and sucks the juices in the same way a mosquito sucks blood. As these insects do not consume the tissues of the leaf or branch poisons are of no avail. Even if the surface be thickly covered with a layer of poison the aphis will thrust its beak through it as well as through the epidermis of the leaf to reach the plant juices beneath. We must therefore attack the insects. This is done by covering them with some caustic substance which will penetrate their bodies or with an oily substance which closes their breathing spores.

Sucking insects cause less damage in Wisconsin at present than biting insects. To the class of sucking insects belong the numerous aphidæ or plant "lice," which attack the young growing shoots of fruit trees, roses, etc. Occasionally nursery stock is injured to some extent by aphids and plum trees are sometimes checked in their growth, but on the whole the injury is slight. Use kerosene emulsion, whale oil soap solution or common soap solution.

To repeat:

(1) Biting or chewing insects are destroyed by placing poison on the parts on which the insects feed.

(2) Sucking insects are destroyed only by attacking the insects and for this class poisons are of no avail.

Plant Diseases.

Apple scab, brown rot of plums and peaches, potato rot, blight, rust and other destructive plant diseases are commonly ascribed to weather conditions. *Indirectly this is often true,* but *neither rain nor drought, nor any other atmospheric condition is ever directly the cause of plant diseases.*

*"Such diseases, as already indicated, are produced by minute plants, which never arise spontanously, but always from some . . . reproductive form of a previously existing plant of the same species. But weather conditions may be favorable to the rapid development of these fungi, and so indirectly cause the disease."

Rainy weather, then, does not directly cause plum rot, but provides conditions favorable to the development of the fungus and probably unfavorable conditions for the development of the plum and its ability to resist the invasion of the disease.

WHAT IS A FUNGUS?

It is a plant; a plant without leaves, flowers, seeds or †chlorophyll.

It cannot therefore prepare its own food, but must feed on other plants.

There are two classes of fungi; saprophytic, which live on decayed or decaying vegetable tissues; toadstools, mushrooms, etc., are examples of this class, and parasitic fungi, which exist on living plants or their fruits, absorbing the prepared nourishment. It is mainly the parasitic class which concerns the fruit grower, for it is this class which causes plant diseases.

Fungi are propagated by spores, minute bodies which may float in the air and are usually too small to be discerned singly without the aid of a compound microscope; collectively these form a dust-like substance as in bread mold, mildew, etc.

These spores alight on leaf or fruit and under favorable conditions of heat and moisture germinate, giving rise to thread-like projections (hyphæ) which penetrate the plant's tissues.

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* Weed, Fungi and Fungicides, p. 11.

† Chlorophyll is the green-colored substance found in flowering plants which enables them to change the crude food, i. e., minerals of the soil to nutritive material (plant tissues) that can be used by animals and plants.

These root-like bodies multiply with great rapidity, feeding upon the juices of the affected plant, forming the *mycelium.*

After a time certain of the modified mycelium (conidia) grow to the surface and produce there spores which are again disseminated. This, in brief, is the life history of a fungous disease. Countless modifications occur with the different species; the spores of some sorts perish soon after dissemination, while others may survive for an indefinite period; some species give rise to two sets of spores, one of which is of brief existence, while the other may persist over winter, etc.

The main fact to be borne in mind is this: The spores which may be present in innumerable numbers may be destroyed or their germination prevented by the application of certain substances known as fungicides *while existing as spores on the outside of plants,* but after the hyphæ have penetrated the tissues of leaf, stem, or root spraying is of no avail. In other words, *spraying for plant diseases must be wholly for prevention.*

Laboratory investigations appear to show that the spores of many common fungi are not destroyed by insecticides and that these are effective only in the short time intervening between germination and the entrance into the tissues of the plant by the hyphæ.

SPECIFIC DIRECTIONS.

The enumeration of the different species of insects and diseases which attack even our common fruits and vegetables can not be attempted in a bulletin. This would require a volume. Therefore in conclusion only brief notes regarding apple scab and brown rot among diseases, and the codling-moth in insects will be given. *Members of this Society are privileged and requested to send to this office at any time specimens of insects or diseases for identification.* To insure safe arrival insects should be enclosed in a tin box or stout wooden box and leaves and twigs wrapped carefully in tissue and then in heavier paper.

APPLE SCAB.

This disease affects both foliage and fruit, appearing on the former as yellow spots which eventually spread and cause the leaves to fall prematurely. On the fruit it appears as rough brown areas, seriously injuring its keeping qualities and market value.

The spores of this disease live over winter, adhering to the buds and bark as well as the fallen leaves, germinating at the time the leaves start in the spring. It is evident then that the most important spraying for apple scab is in early spring before the buds open, that we may destroy or prevent the germination of the spores. For this spraying copper sulfate may be used dissolved in water at the rate of 2 lbs. to 50 gallons of water.

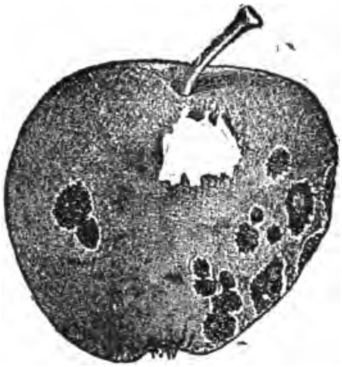

FIG. 11. An apple affected with scab.

The trees should be sprayed again as soon as possible after the blossoms have fallen and a third time ten days later. Bordeaux mixture should be used for these sprayings, combined with Paris green or arsenate of lead. *Do not use copper sulfate on growing trees or plants unless combined with lime.* Always use Paris green or arsenate of lead with the Bordeaux mixture (¼ lb. Paris green or 2 lbs. arsenate to 50 gallons Bordeaux) when spraying bearing apple orchards and in this way combat both scab and codling-moth at one operation.

PLUM ROT; FRUIT ROT; BROWN ROT.

This destructive fungus is the most provoking as well as the most destructive of plum diseases. It usually affects the ripening fruit, causing it to decay rapidly while still on the tree.

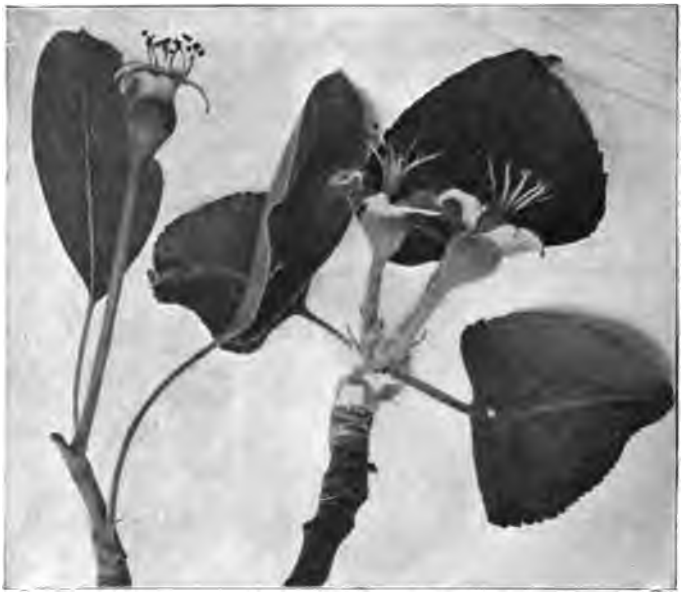

FIG. 12. "Just right to spray. A pear and two apples from which the petals have recently fallen. Note that the calyx lobes are widely spread." Illustration and legend copied from Bull. 142 Cornell Univ., N. Y. M. V. Slingerland, author.

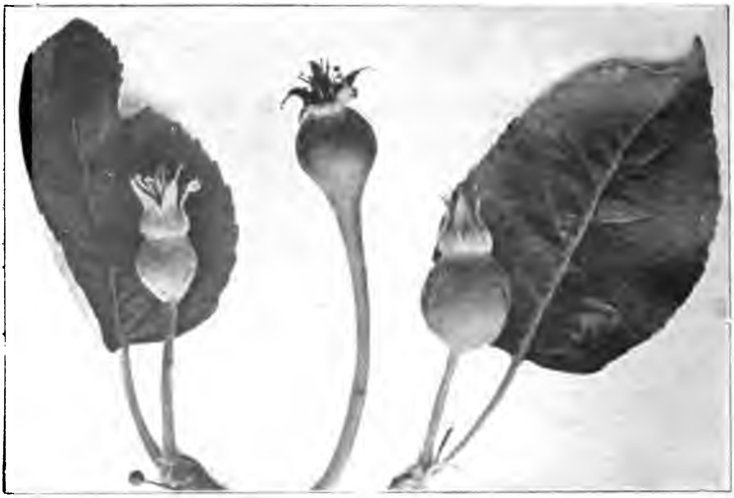

FIG. 13. "Almost too late to spray apples effectively. Note that the calyx lobes are drawn nearly together, while on the pear in the center, the calyx-cavity is open." Illustration and legend as above.

The skins of the affected fruits are covered with grayish postules or spore masses which serve to perpetuate the disease.

The spores may gain entrance very early in the season, lodging in the bud scales very early in spring and as the buds open find a congenial field in the growing tissues where they usually exist through the summer, finding their favorite feeding ground in the ripening fruit.

Occasionally, however, it does not wait so long but if the weather conditions are favorable, attacks the blossoms, causing them to decay and may thus wholly prevent the setting of fruit.

Moist, warm weather favors the progress of the disease.

It is probable that this disease may be largely if not wholly controlled by spraying. The first spraying should be done very early in the spring, before the buds open and at this time the copper sulfate solution advised for apple scab may be used. At the close of the blossoming season a thorough application of Bordeaux should be given, and again later in the season if any suspicion exists that the evil has not been overcome.

Where the plums hang on the tree so thickly as to touch, they are apt to rot, as the moisture which collects at the points of contact produces a softening of the tissues which afford an opportunity for the germs to enter. It is advisable then to thin the fruit severely before ripening time.

CODLING-MOTH.

The mature insect, a night-flying moth, is rarely seen. The first brood of moths appears about the time the blossoms open, arising from cocoons which may be found beneath the roughened bark of old trees or more commonly in the refuse on the ground in neglected orchards. The eggs are deposited soon after the blossoms fall, on the fruit and leaves. The eggs hatch in seven to ten days, and the larva or "worm" finds easy entrance to the interior of the apple at the calyx or blossom end. The remainder of the story is well known; wormy apples are exceedingly common in Wisconsin.

To successfully combat this pest, which in the early stages is a caterpillar scarcely one-sixteenth of an inch in length and which at once proceeds to the interior of the fruit, would seem a hopeless task and yet much may be accomplished by timely action.

For several days after the blossoms fall the immature apple retains an upright position on the stem with the calyx lobes spreading outward. This is the time to spray, and in common with practically all work of this kind must be preventive. The object to be attained in this spraying is to deposit a drop of poisoned water *in the calyx cavity* and to cover as far as possible the outside of the fruit as well as the leaves so that the caterpillar will be obliged to eat the poison in attempting to gain entrance.

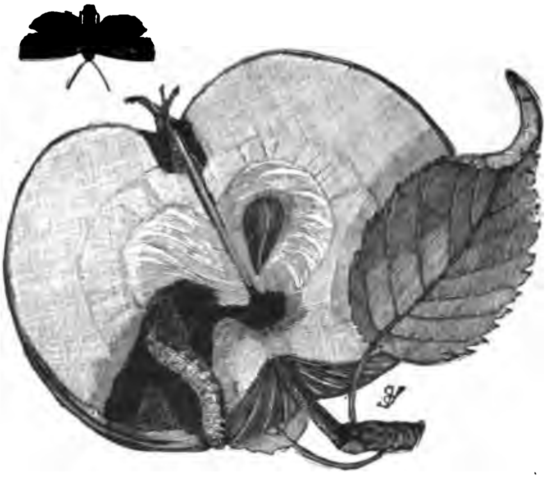

FIG. 14. Copied from The Spraying of Plants, by Lodeman, and used by permission of the publishers, The Macmillan Co., New York.

After three or four weeks the calyx lobes close and later the little apples turn downward, rendering the proper application of poisons a difficult task. For further security a second application of the poison should be made in eight or ten days, as the egg laying extends over several days.

In case of heavy rains before the calyx closes, an additional spraying may be necessary. Theoretically, the later the poison is applied, the better, if done *before the calyx closes.* Rains after this period will do but litle harm as the poison is protected by a roof formed by the calyx lobes.

The course outlined above would be sufficient to completely rid our orchards of the codling-moth in a short time if it were not for the

SECOND BROOD.

Many of the caterpillars of the first brood leave the apples at maturity and sheltered by crevices in the bark or in other secure places complete their transformation to emerge in July or August as moths; these again deposit eggs which enter the fruit when near maturity. Against this brood we are nearly helpless so far as spraying is concerned, although many growers report partial success as a result of thorough spraying in August. A partial remedy consists in trapping by banding the trees. This consists of placing bands of burlap, cotton or even hay ropes about the trunks of the trees in June or July.

The larvae collect beneath these, which should be removed once a week and the caterpillars or pupas destroyed. A majority of the larvae leave the apples before they fall but many remain. It is advisable, therefore, to collect and destroy all windfalls. By these two means we may in a measure prevent the ravages of the second brood and materially reduce the crop of moths which would otherwise hibernate, but in no case should the early spraying be neglected, and if thoroughly done in proper season there will be no second brood of moths.

Other biting insects which attack the apple are:

Canker worm and tent caterpillar.

Fortunately neither of the two named are common enough in Wisconsin to warrant an extended notice at this time; further, the spraying recommended for the codling-moth is sufficient to destroy either or both of these pests as they appear early in the season.

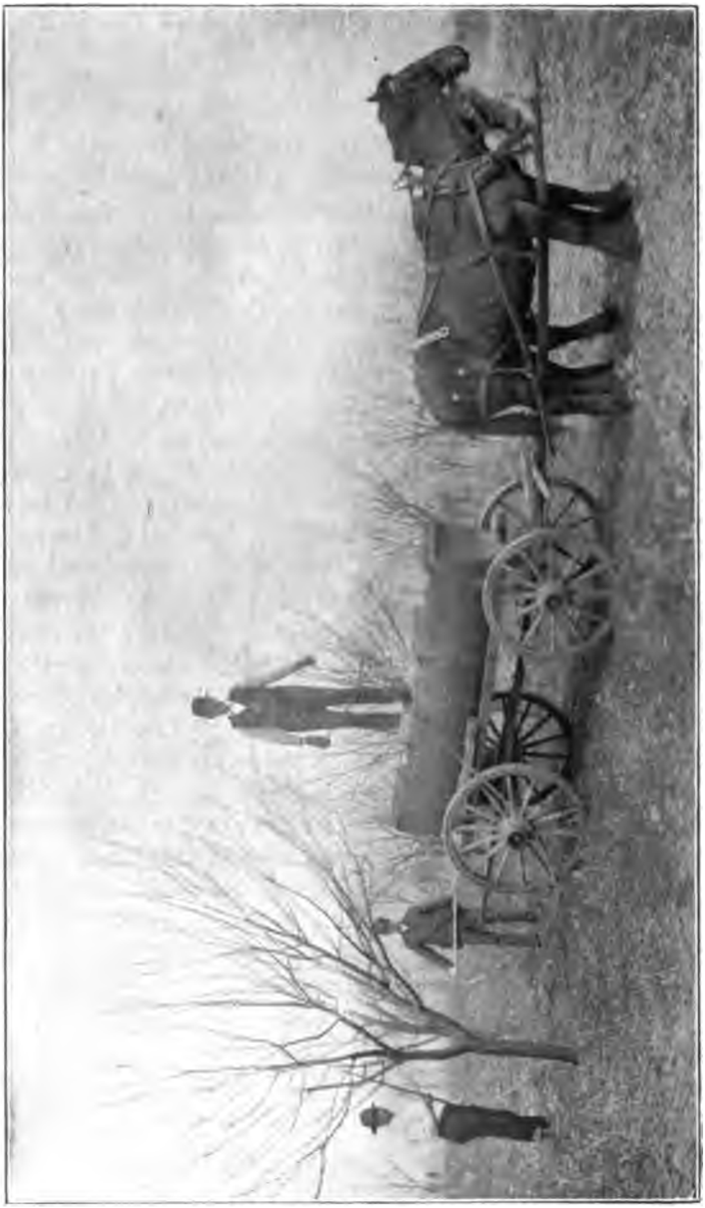

FIG. 15. Spraying in the trial orchard at Wausau.

Acknowledgements.

Figs, 2, 3 and 11 are from the principles of Plant Culture by E. S. Goff, and used by permission of the publishers, The Co-Operative Pub. Co., Madison, Wis.

Figs. 4, 7, 8 and 9 loaned by Morrill & Morrill, Benton Harbor, Mich.

Fig. 4a loaned by Gould's Mfg. Co., Seneca Falls, N. Y.

WISCONSIN

State Horticultural Society

BULLETIN NO. 14

BUYING NURSERY STOCK

Supplementary to Bulletin No. 7, Wisconsin State Horticultural Society

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MADISON, WIS., NOVEMBER, 1908

☞ The Bulletins and Annual Reports of This Society are sent free to members of the Society

Notice

While the subject matter of this bulletin has been prepared in as brief and concise a manner as seemed consistent with the nature of the topic it is possible that some who receive it may desire even less. For such there is here submitted the following

Summary and Index

Not all nursery agents are swindlers—only a small percentage. See P. 3.

Not necessary to go outside of Wis. for nursery stock. See list of Wis. firms. P. 5

Buy no "Contract Orchards". See Pp. 7-13.

The Seedless Apple and the Strawberry-Raspberry are merely novelties and not worth the price asked. Pp. 13-14.

Swindlers are at work in this state, and not the least dangerous is the agent who represents that he is employed by this society. P. 14.

List of fruits recommended (general). Pp. 17-18.

Condensed list for home orchard, etc. P. 10.

List of hardy ornamental plants. Pp. 20-21.

The Wis. State Horticultural Society, Aims and Purposes. Pp. 21-23.

Buying Nursery Stock

PART I.

Most of the nursery stock which is planted in Wisconsin is purchased in small lots from traveling agents of nursery firms, sometimes slightingly referred to as "tree peddlers."*

It is probably safe to say that most of these agents represent reliable firms, transact business in an honest manner and sell at fair prices.

No doubt some buyers who have met with unfortunate experiences in buying trees or plants may question this statement but the writer firmly believes that the estimate is fair. Of the small percentage not falling within the above class, probably one-half or more are downright swindlers and the remainder agents of reputable firms who, under stress of keen competition, make statements and promises not authorized by the firms employing them. These agents usually sell on a commission basis and not infrequently meet sharp practices on the part of their competitors with equally doubtful methods.

It is not claimed that these estimates are founded on established facts but are merely opinions based on observation and any reader is at liberty to question them or formulate entirely different estimates.

It is not always easy to distinguish the honest, fair dealing agent from the irresponsible one but it is not too much to demand of an agent that he should show conclusively that he is, in fact, the regularly appointed agent of the firm he claims to represent and that he furnish proof in the way of statements from banking houses, commercial agencies or other reliable sources that the firm he represents is a responsible one. Some nursery firms exist only on paper.

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*Several Wisconsin firms sell only by the catalog or mail order plan, some having an extensive patronage, while others sell only small fruit plants such as strawberry, etc.

Wisconsin Nurseries

A circular letter was recently mailed to each of the nursery firms whose names appeared in the report of the State Nursery Inspector for 1907, soliciting answers to the following questions:

"Do you offer a complete line of nursery stock such as fruit trees, small and bush fruits, ornamental plants, etc.?"

"If only special lines are carried please indicate these."

"Do you employ agents?"

"Do you issue a catalog and price list?"

"In which of these ways, mail order or agents is the bulk of your business done?"

"How many acres in your nursery?"

These questions were sent to seventy-four firms and replies received from fifty-one. From the answers submitted the following facts are noted: Sixteen of these firms sell only through agents. Twenty sell by catalogue or mail orders. Ten do only a local trade mainly in berry plants.

In size these nurseries range from two to eighty acres in extent. Many are small nurseries selling only to local trade, others do an extensive business both in this and adjoining states. *No statement or list here given should be construed as recommending any firm nor as a guarantee of any nature whatsoever,* the prime object being to call the attention of readers to the fact that we have in our own state nurseries sufficient in extent to supply all present needs. If perchance any of these firms should fail to give a "square deal" the offender is always within easy reach as the agents who sell in Wisconsin for Wisconsin firms usually cover the same territory for several successive years and are not afraid to meet their former customers. This is not always true of outside firms.

WISCONSIN NURSERIES.

NAME	Address	Are Agts. Empl'y'd	Catalog & Price List	In which way is most business done
Badger State Nursery Co...	Reedsburg	Yes.	....	Agents.
Baker, H. J................	Fond du Lac....	Yes.	No.	Agents.
Barnes, A. D................	Waupaca	Yes.	Yes.	Mail Orders.
Bingham, D. E.............	Sturgeon Bay....	No.	No.	Local Trade.
Bright, W. H..............	Ft. Atkinson.....	No.	No.	Agents.
Brown, A. D................	Baraboo	No.	No.	Local Trade.
Brown, W. W., Nursery Co.	Hartland	Yes.	No.	Agents.
Cascade Nursery Co........	Osceola	Yes.	No.	Agents.
Carpenter, L. A.............	Fond du Lac....	No.	....	Mail Orders.
Chappel, F. H..............	Oregon	No.	Yes.	Local Trade.
Coe, Converse & Edwards Co.	Ft. Atkinson.....	Yes.	Yes.	Agents.
[redacted]	[redacted]	Yes.	No.	Agents.
Currie Bros..................	Milwaukee	No.	Yes.	Mail Orders.
Evans, L. H.................	Sparta, R. F. D. 3	No.	No.	Mail Orders.
Evergreen Nursery Co......	Sturgeon Bay....	No.	Yes.	Mail Orders.
Fadner, Paul V.............	Chilton	No.	Yes.	Mail Orders.
Great Northern Nursery Co.	Baraboo	Yes.	Yes.	Agents.
Haentze, E.................	Fond du Lac....	No.	No.	Local Trade.
Hanchett, Geo. & Son......	Sparta	No.	....	Mail Orders.
Harris, H. H. & Sons.......	Warrens	No.	No.	Loc. T. & M. O.
Harrison, W. J..............	Baraboo	Yes.	Yes.	Mail Orders.
Hawks Nursery Co..........	Wauwatosa	Yes.	Yes.	Agents.
Herbst Bros.................	Sparta	No.	Yes.	Mail Orders.
Jepson, Nels P.............	Waupaca	Yes.	Yes.	Agents.
Jewett, Z. K................	Sparta	Yes.	No.	....
Jorgenson, Geo. & Son......	Poysippi	No.	Yes.	Mail Orders.
Kauffman, Herman..........	Marshfield	No.	No.	....
Kellogg's Nursery..........	Janesville	No.	Yes.	Mail Orders.
Lake's Sons Co., Henry.....	Black Riv. Falls.	Yes.	Yes.	Agents.
Mack, S. B..................	Monroe	Yes.	No.	Agents.
Marsh, H. F................	Antigo	No.	No.	Loc. T. & M. O.
Matthewson, J. E...........	Sheboygan	No.	Yes.	Mail Orders.
McKay Nursery Co..........	Pardeeville	Yes.	Yes.	Agents.
Pearson, Charles L.........	Baraboo	Yes.	Yes.	Mail Orders.
Peffer, Wm.................	Pewaukee	No.	No.	Local Trade.
Phoenix Nursery Co.........	Delavan	No.	No.	....
Pratt, Chas. H..............	Marshfield	No.	No.	Local Trade.
Salzer, John A. Seed Co....	La Crosse........	No.	Yes.	Mail Orders.
Schucht, Otto..............	Sheboygan	No.	No.	Local Trade.
Shiocton Nurseries..........	Shiocton	Yes.	Yes.	Mail Orders.
Stewart, J. E...............	Rock Elm........	No.	No.	....
Stirdivant, Geo.............	Sheboygan Falls.	No.	Yes.	Mail Orders.
Sullivan, E. W..............	Alma Center.....	No.	No.	Local Trade.
Tamblingson, A. F. & Sons.	Ft. Atkinson.....	Yes.	Yes.	Agents.
Toole, Wm. & Sons........	Baraboo	No.	Yes.	Mail Orders.
Uecke, Chas. F.............	New London.....	No.	Yes.	Mail Orders.
Whelan Bros................	Watertown	No.	Yes.	Local Trade.
White Elm Nursery Co.....	Oconomowoc	No.	....	Mail Orders.
Wisconsin Nurseries.........	Union Grove.....	No.	Yes.	Mail Orders.
Wood, John F...............	Twin Bluffs......	Yes.	No.	Agents.
Yahr, Solon.................	West Bend......	Yes.	No.	Agents.

Considering further this question of buying nursery stock, certain other propositions may be considered.

1. Every nursery agent is entitled to a hearing. An agent may not be justified in breaking in on the time of a busy farmer or business man but if he asks for an appointment, it is due to him to grant it.

2. The agent who sells good trees and plants at a fair price is a public benefactor. Every family should be provided with an abundance of fruit and the home grounds with shade and ornamental trees, shrubs, vines and flowers. The "tree peddler" in inducing home owners to buy these things is deserving of encouragement.

3. Nursery agents in common with other salesmen are good talkers but unfortunately many of them possess but a superficial knowledge of the goods they offer for sale. Traveling men for staple lines of merchandise are fitted for their work by an apprenticeship, giving them a thorough knowledge of the goods they are to sell while too often nursery agents are selected solely on account of their talking abilities. It would seem that a corps of well trained agents familiar with varieties and requirements of the different sections of the state would prove extremely profitable to the firm employing them as well as a distinct benefit to the communities solicited.

Extraordinary Methods

Two ordinary methods of selling nursery stock have been mentioned, viz., by personal solicitation of orders that are paid for in full on delivery and by catalogue or mail order. There remains, however, another and somewhat extraordinary method which has been practiced extensively in this state known as the "Contract Orchard plan."

Contract Orchards

Inquiries multiply each succeeding year from members and others regarding the different contract orchard firms operating in the state and considerable time has been spent in investigating the plans pursued by these companies. The "Contract Orchard" has fallen into disrepute of late. Some years ago different reputable and responsible members of this Society engaged in the practice of selling orchards on contract receiving a portion of the price in cash and agreeing to take the remainder at the end of a term of years or in lieu thereof a portion of the first crop. So far as can be learned these contracts were faithfully carried out by the seller and to the satisfaction of the buyer.

Within the past five or six years, however, there have appeared in the state, representatives of firms claiming headquarters and extensive nurseries in Ohio, Michigan and other states selling orchards on contracts of which the following is a fair sample.

ORCHARD CONTRACT

between

THE NORTHWESTERN NURSERY AND ORCHARD CO.

D. S. Webb & Co., Proprietors,
of St. Joseph, Michigan.

Party of the first part and ——— of ———, County of Richland, State of Wisconsin, of the second part

Witnesseth: That the undersigned have agreed to enter into the following contract:

This Company, party of the first part, will furnish to party of the second part the following bill of trees, etc., for the purpose of improving my property.

112 Apple.
Crab.
18 Pear.
42 Plum.
Prune.
Cherry.
Peach.
Quince.
Grape.
Gooseberry.
Currant.
Blackberry.
Raspberry.
Strawberry.

Varieties written on Back Hereof.

All to be first class stock. At the proper time to plant the trees above mentioned, the said second party shall have prepared the ground and agrees to have same in good state of cultivation, and to plant the trees above mentioned according to printed instructions

furnished by the Company. The party of the first part agrees to trim or prune the trees at the proper time, and to replace any trees, etc., that may die within five years from the date of delivery free of cost, except trees that may be destroyed by stock or peeled or girdled by rabbits or mice.

In consideration of the above mentioned goods furnished and services performed by the party of the first part, the said second party agrees to pay the said Company Ninety Dollars ($90.00) cash on delivery at ———, State of Wisconsin, in the fall of 1904, and Ninety Dollars ($90.00) in cash on or before the fall of 1909, being five years from date of delivery, all cash payments due and payable at the office of the Company at St. Joseph, Michigan, or the Northwestern Nursery & Orchard Co., party of the first part will accept one half of the fruit produced the season of 1910 instead of above second cash payment, at the option of the party of the second part. The fruit to be delivered to nearest railroad station to purchaser.

The party of the second part further agrees that should I sell or otherwise dispose of the land on which this orchard is planted, during the life of this contract the deferred payments are due and payable at once. Said second party also agrees to cultivate and care for this orchard according to instructions furnished and to keep the same free from weeds and grass. Said second party agrees not to countermand this contract.

In Testimony Whereof, the Northwestern Nursery and Orchard Co., by its agent and said second named party have hereunto set their hands and seals this day of 190

THE NORTHWESTERN NURSERY & ORCHARD CO.
Party of the First Part
By J. S. WEATHERHEAD, Agent.

Signature of ....

Purchaser. ....
Party of the Second Part.

As may be seen from this the owner of the land agrees to pay $180.00 for 172 trees.

There are no doubt fifty reliable nurserymen in Wisconsin who are in a position to furnish a similar amount of stock for considerably less than one-half this amount. The owner therefore pays the balance or $90.00 for the promise on the part of the company to "trim" and replace for five years. *The first payment is always sufficient to insure a profit.*

As a rule reliable nursery firms do not give such a guarantee neither, as far as can be learned do horse owners give any guarantee when selling a horse that it will not die nor become affected with spavin, heaves or poll-evil. One is about as reasonable as the other.

The agreement to prune the trees is sometimes fulfilled in a haphazard manner, but trees which die are rarely replaced. The above mentioned company, reputed to have headquarters in St. Joseph, Michigan, operated extensively in Taylor County in 1904 and 1905. In 1908 a representative of this Society investigated several contract orchards sold by this firm and report as follows:

SECRETARY OF THE STATE HORTICULTURAL SOCIETY:

I submit herewith the following report relative to the operations in Clark and Taylor Counties of the Northwestern Nursery and Orchard Company, claiming to have headquarters at St. Joseph, Michigan, Agent Charles Hudson.

The farmers named below were *interviewed* so that this report is not based on hearsay, guesses nor imagination.

I first visited the farm of F. McCumber about three and one-half miles west of Westboro, Taylor County, Wisconsin. Mr. McCumber entered into a contract during September, 1906, with the N. W. N. and O. Co., for nursery stock, both stock and contract agreeing in all important details with the original contract filed in your office.

On the 27th day of October, 1908, Mr. McCumber's orchard contained fifteen trees which were alive out of forty trees planted. No trees, to date, had been provided to take the place of dead trees, neither had any representative of this N. W. N. and O. Co. appeared on the ground to trim or prune the trees.

(b) The farm of B. G. Engstrom, between five and six miles north of Westboro, was visited. Evidently fifty-six apple trees had originally been planted on a favorable slope thoroughly cultivated. Twenty-five of these trees were alive and for the most part were very good trees, but their growth must have been slow, otherwise the trees could hardly have averaged seven feet high at planting as the contract guaranteed. No trees replaced, no pruning done by the nursery company.

(c) Also visited the orchard of Peter Bjorquist. This orchard was reported the best orchard near Westboro; however, the word *best* applied here would humiliate any orchardist in Wisconsin. There were twenty-eight to thirty trees two years planted under contract, a large per cent dead, no pruning, no substitution of live trees for those dead. In this orchard there were fourteen trees large enough to bear fruit, none this year, neither had they been planted under contract.

(d) I finally found a man, in the person of J. B. Jorgensen, who had preserved his contract. Mr. Jorgensen reported $20.00 the actual price paid for his twenty-five apple trees and such other nursery stock as is listed on the original contract herewith submitted. In the spring of 1908 the trees had died down to the roots, which were pulled out and the land sowed to oats. Good cultivation, no pruning, no live trees furnished by orchard company.

(e) Chauncey Wilmot, town clerk, was another victim who dropped $25.00 for twenty-five apple trees and a variety of other trees and shrubs. Few alive; regards the company as a swindle.

The agent's personality from very meager accounts was in every case a tall middle-aged man, slightly stoop-shouldered with a voice that caressed you, and charmed with a potent hypnotic personality. I was not able to find any promissory notes, the agent always preferring to allow rebates large enough to make it an object for the purchaser to pay cash.

This same nursery company or one operating in a similar way canvassed Clark County also.

A suggestion might not be wholly out of place in this report leading up to a plan of publicity by our society to prevent much of the fraud being practiced by dishonest nurserymen upon our prospective and unsophisticated fruit growers. Some plan might be adopted whereby the children in our county district schools should be instructed by their teachers not only what trees and shrubs should be planted but also these which might prove a failure; and further the tree and the price of it should be associated.

As a part of this report I file with you an original contract between the Northwestern Nursery & Orchard Company, St. Joseph, Michigan, and John B. Jorgensen, Westboro.

Madison, Wis., Nov. 2nd, 1908. G. W. Reigle.

Original.

ORCHARD CONTRACT

between

THE NORTHWESTERN NURSERY AND ORCHARD CO.

D. S. Webb & Co., Proprietors,
of St. Joseph, Michigan

Party of the first part and....John B. Jorgenson
of ....Westboro.................................P. O.,
County of....Taylor...., State of..Wis..of the second part
Witnesseth, That the undersigned have agreed to enter into the following contract:
This Company, party of the first part, will furnish to party of second part the following bill of trees, etc., for the purpose of improving............property:

25 Apple	8 Cherry	3 Currant
2 Crab	Peach	Blackberry
Pear	Quince	Raspberry
8 Plum	Grape	Strawberry
Prune	3 Gooseberry	

Varieties Written on Back Hereof.

All to be first-class stock. At the proper time to plant the trees above mentioned, the said second party shall have prepared the ground and have same in good state of cultivation. ~~To plant the trees above mentioned according to printed instructions furnished by the company~~. The party of the first part agrees to trim or prune the trees at the proper time, and to replace any trees, etc., that may die within five years from the date of delivery free of cost, ~~except trees that may be destroyed by stock or peeled or girdled by rabbits or mice.~~

In Consideration of the above mentioned goods furnished and services performed by the party of the first part, the said second party agrees to pay....Twenty Five.............Dollars ($.25.00/100..), cash on delivery at his farm when planted Co. of....Taylor.........State of...Wisconsin... in the.Spring..of 1906.., and. half the apples grown on orchard Season of 1911...Dollars ($...........) ~~in cash on or before~~..........................~~190~~.., ~~being five years from date of delivery, all cash payments due and payable at the office of the Company at St. Joseph, Michigan.~~

~~The party of the second part further agrees that should...... ......sell or otherwise dispose of the land on which this orchard is planted, during the life of this contract the deferred payments are due and payable at once~~. Said second party also agrees to cultivate and care for this orchard according to instructions furnished and to keep the same free from weeds and grass. Said second party agrees not to countermand this contract.

In Testimony Whereof, THE NORTHWESTERN NURSERY AND ORCHARD Co., by its agent and said second named party have hereunto set their hands and seals this..27th..day of ..Sept.....1905.

THE NORTHWESTERN NURSERY & ORCHARD CO.
Party of the First Part.

By ....Agent.

Signature of Purchaser {
....
....

Party of the Second Part.

The plan of operation and prices charged vary with different companies and the location worked. Farmers in Washington County, in 1907, gave orders to an Ohio contract orchard firm which called for the payment of one hundred and ten dollars for stock which might have been bought from any Wisconsin nursery for twenty-five dollars. Sixty dollars was to be paid on delivery of stock and fifty dollars in 1912 or one-half of the crop in 1913.

Barron County farmers in 1907 were asked to pay but thirty-six dollars per hundred for trees but the agents were able to convince them that apple, cherry and plums should be set 12 by 12 ft. apart or over three hundred trees per acre. On the whole *the contract orchard plan is a very ~~good~~ poor way to buy trees.*

Budded vs. Grafted Trees

Occasionally or even frequently agents will advocate the purchase of budded trees in preference to those root grafted. This is a subject that has occasioned much discussion in different sections but the best informed horticulturists agree, so far as the apple is concerned, that root grafted trees are best for this climate. Next to these come trees top grafted on crab or other hardy stock while budded trees are poorest of all.

These conclusions are based on facts connected with the propagation of trees and on climatic conditions requiring too much space to present at this time.

The "Seedless" Apple

For several years a novelty known as the Spencer Seedless, Bloomless and Coreless apple has been widely advertised and offered for sale at two dollars per tree.

The history of this variety was discussed at length in Bulletin No. 11 of this Society, wherein it was shown that the fruit is neither seedless nor coreless; that far from being proof against codling moth, as claimed, the shape of the fruit, large open calyx cavity, affords unusual opportunities for the entrance of the apple worm. It was also shown, from offers of Wisconsin nurserymen, that at least one-half dozen first class trees of standard varieties could be had for the price asked for one tree of the Spencer Seedless and Coreless, which was neither seedless nor coreless.

The Strawberry-Raspberry which is neither a strawberry nor a raspberry nor even a hybrid of these, but a distinct species, a rank growing bush yielding rather showy fruit distinctly inferior to the red raspberry, has been sold at extravagant prices.

These and numerous other novelties (fakes) are continually being offered for sale. It is a good plan to purchase standard varieties first and these will yield enough profit to warrant the purchase of the novelties later—if these are still in existence.

Humbugs

These are plentiful and to attempt their extermination is a well-night hopeless task for as soon as one is killed off another appears. The best that can be done is to give due warning to the public.

The latest of these "nature-fakirs" of which the writer has any knowledge represented himself as employed by the State Horticultural Society to give instructions in pruning fruit trees, etc., etc., incidentally at the close of his lesson taking orders for nursery stock.

According to reports from sections of Walworth and Racine Counties this agent did a thriving business until arrested and fined for such misrepresentations. It should be known that neither this Society nor any department of the University employs any person or persons for the purpose of selling nursery stock, that neither of these departments nor any other state department has any such stock for sale and any orders taken on the strength of such representations are fraudulent. The officers of this Society should be notified at once of such practices.

Numerous other petty schemes might be cited but it is thought best to close this part of the discussion with the following suggestions:

Buy of Wisconsin firms.

Buy only standard varieties.

Buy no contract orchards.

Buy no seedless apples.

Don't buy of any agent who represents that he is employed by this Society, the Agr. College, the Experiment Station or any other state department. All such agents are swindlers.

PART II.

As considerable advice has been given in Part I regarding what not to buy, this publication would appear incomplete if it did not contain some suggestion about the kinds one ought to buy.

In this connection it should be understood that no list can be given that will apply to all parts of the state. The distance from the southern to the northern boundary of Wisconsin is over 300 miles thus including five parallels of latitude; the distance from east to west about 270 miles and within this area is found soil conditions of every kind known in the North Temperate Zone, and it is now generally recognized that soils, drainage and other conditions of local environment play a very important part in the behavior of the different varieties of fruits.

It has also been learned from bitter experience in Wisconsin that the prime requisite for any variety of tree fruit is hardiness, i. e., its ability to withstand extremes of heat and cold. With bush fruits and berries hardiness is not necessarily the question of first consideration as these may be protected, at least in winter.

While the compilation of lists best adapted to each particular locality is impractical, there are nevertheless certain lists that may be given, which, with the reservations noted, may be accepted as reliable guides for planting. These lists have grown out of the experience of members of this Society during the past fifty-five years.

The lists given below may be accepted as standard for at least two-thirds of the state. The northern one-third of Wisconsin roughly speaking, presents conditions of soil and climate not yet fully tested for tree fruits and it is likely that the lists here given may require revision for this section of the state.

List of Fruits Recommended for Culture in Wisconsin

By the State Horticultural Society

APPLES. (General List).

Alexander, Astrachan (Red), Autumn Strawberry, Dudley, Fall Orange, Fameuse (Snow), Golden Russett, Hibernal, Lowland Raspberry, Longfield, Lubsk Queen, McIntosh, Malinda, McMahan, Newell, Northwestern Greening, Oldenburg (Duchess), Patten Greening, Perry Russett, Plumb Cider, Scott, Tetofski, Talman (Sweet), Utter, Wealthy, Westfield (Seek-no-Further), Windsor, Wolf River, Yellow Transparent.

APPLES. (Lake Shore List.)

In addition to the above many other varieties including the following may be successfully grown in the extreme southern part of the state and in the counties bordering on Lake Michigan: Baldwin, Eureka, Fallawater, Gano, King, Northern Spy, Pewaukee, Willow Twig, York Imperial, Bellflower.

CRABS.

Brier Sweet, Hyslop, Lyman, Martha, Sweet Russett, Transcendent, Whitney.

PLUMS.

Of the classes commonly cultivated, viz: European, Japanese and Native or American, the last named is the most reliable.

NATIVE PLUMS.

De Soto, Forest Garden, Hammer, Hawkeye, Ocheeda, Quaker, Rockford, Surprise, Wyant.

CHERRIES.

Early Richmond, Montmorency.

GRAPES.

Brighton, Campbell's Early, Concord, Delaware, Diamond, Green Mountain, Moore's Early, Niagara, Worden.

BLACKBERRIES.

Briton (Ancient), Eldorado, Snyder.

STRAWBERRIES.

Varieties starred have imperfect flowers and must not be planted alone.

Bederwood, *Crescent, Clyde, Dunlap, Enchance, Gandy, Glen Mary, *Haverland, Lovett, *Sample, Splendid, *Warfield.

RASPBERRIES.

Black: Conrath, Cumberland, Gregg, Older.
Red: Cuthbert, Loudon, Marlboro.
Purple: Columbian.

CURRANTS.

Red: Red Cross, Red Dutch, Long Bunch Holland, Victoria.
White: White Grape.
Black: Lee's Prolific, Naples.

GOOSEBERRIES.

Downing.

PEARS.

On account of the prevalence of blight and winter killing, pears are not generally recommended for Wisconsin. Good crops are occasionally produced under favorable conditions, especially in the southeastern part of the state. The following list includes both early and late varieties:

Bartlett, Clapp Favorite, Early Bergamont, Flemish Beauty, Idaho, Kieffer, Lawrence, Seckel, Sheldon, Vermont Beauty.

For the Home Orchard and Garden

The following condensed lists are given by the way of suggestion to those who wish to plant a small (kitchen) orchard and fruit plantation. All are hardy.

APPLES. Five Varieties for Farm Orchard.

Northwestern Greening, Oldenburg (Duchess), Talman (Sweet), Wealthy, Yellow Transparent.

NATIVE PLUMS.

De Soto, Rockford, Surprise.

GRAPES.

Concord, Moore's Early, Niagara.

BLACKBERRIES.

Eldorado.

TWO VARIETIES STRAWBERRIES FOR FARM GARDEN.

Dunlap, *Warfield.

RASPBERRIES.

Black: Gregg, Older.
Red: Loudon.
Purple: Columbian.

CURRANTS.

Red: Red Cross.
White: White Grape.
Black: Lee's Prolific.

GOOSEBERRIES.

Downing.

FLOWERING AND ORNAMENTAL PLANTS.

When buying nursery stock the decoration of the home grounds should not be neglected. From among the many ornamental plants offered by nurserymen the following may be selected, all of which are hardy:

Common Barberry.
Purple-leaved Barberry.
Thunberg's Barberry.
Weigelas.
Garden Hydrange.
Tartarian Honeysuckle.
Mock Orange.
Missouri Flowering Currant.
Rose Acacia.
Japanese Rose.
Golden Elder.
Buffalo Berry.
Spiraeas.
Persian Lilac.
Chinese Lilac.
Common Lilac.
Snowball.

The following select list of six shrubs is recommended for the home grounds all reliably hardy in any part of the state:

Common Lilac.
Tartarian Honeysuckle.
Rosa Rugosa.
Mock Orange or Syringa.
Van Houten's Spiraea.
Common Barberry.

For covering porches, arbors or outbuildings the following vines may be employed:

Ampelopsis or American Ivy (native in Southern Wisconsin).
Wild Grape.
Trumpet Honeysuckle (native).
Clematis paniculata.
Bittersweet (native).

ROSES.

If hardy roses are wanted, kinds that will thrive without winter protection, the list must be a very limited one. The following are hardy "June" roses flowering but once each season, with the exception of the Rugosa or Japanese rose which often blooms in autumn as well:

Harrison Yellow,
Persian Yellow.
Madame Plantier.
Rugosa or Japanese.

Rose lovers will not be satisfied with these and will plant varieties of the Hybrid Perpetual class. These kinds produce finer flowers than the June roses and bloom through a longer period but demand better care through the growing season and must be covered in winter.

Twelve varieties of hybrid roses:

Paul Neyron,
Mrs. J. H. Laing.
Gen. Jacqueminot.
Dinsmore.
Marshall P. Wilder.
Coquettes des Blanches.
Earl of Dufferin.
Jules de Margottin.
Vick's Caprice.
Magna Charta.
Prince Camille de Rohan.
General Washington.

PART III.

AIMS AND PURPOSES OF THE WISCONSIN STATE HORTICULTURAL SOCIETY.

Organized in 1865, being the legitimate successor of the Western Fruit Growers' Association which was organized in 1853.

Chartered by the State of Wisconsin in 1871.

Purely an educational institution.

Its purpose the advancement of every branch of horticulture throughout the state.

Aims to accomplish this through conventions (two yearly), publications and individual help.

Issues an Annual Report (250 to 300 pages) containing articles on orchard culture, small fruit and vegetable gardening and the decoration of home grounds. Sent free to members.

Issues bulletins on practical subjects written in plain language and free from technical terms including pruning, spraying, planting, etc. Sent free to members.

Individual help is furnished through the Secretary, who obtains from reliable sources information on any horticultural topic. Free to members.

Maintains ten trial orchards or stations at as many different places in Wisconsin, the northern stations being for the purpose of testing the different varieties of tree fruits; the others for demonstrating that apple and grape growing may be very profitable lines of work. Absolutely free to all people of Wisconsin.

Receives an annual appropriation from the state for the support of these stations.

Maintains a membership of 100 life members and over 700 annual members.

Aims constantly to increase this membership, as by this means more and better work may be accomplished.

Requires but fifty cents for annual membership fee and five dollars for life membership. (Note privileges above.)

Cordially invites every person in Wisconsin who knows something about fruit, flowers, or vegetables to become a member, as such persons are needed to help along the splendid work in which the Society is engaged.

Extends an urgent invitation, a promise of help and the hand of fellowship to all who want to know about the growing of fruit, flowers or vegetables; to all who love the beautiful in nature a hearty welcome is assured.

Every reader of this is invited to join our Society. No formal application is necessary. Forward the fee to the Secretary State Horticultural Society at Madison who will immediately send you a receipt and copy of the latest annual report and all bulletins available. You will also be entitled to all other privileges of membership.

Wisconsin State Horticultural Society

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The Bulletins of the Society are sent free to members. Persons not members may obtain copies until the editions are exhausted on application to the Secretary.

Annual Membership	$0.50
Life Membership	5.00

Remit to Secretary W. S. H. S.
Madison, Wis.

WISCONSIN

State Horticultural Society

BULLETIN NO. 15

SPRAYING

Supplementary to Bulletin No. 13, Wisconsin State Horticultural Society

MADISON, WIS, MARCH, 1909

☞ The Bulletins and Annual Reports of This Society are sent free to members of the Society

This Bulletin Contains the Formula for

BORDEAUX MIXTURE

and Directions for its Preparation

PLEASE PRESERVE FOR FUTURE REFERENCE

READY REFERENCE

FOR THE CURRANT WORM: **Poison the foliage with white hellebore, P. 7. Arsenate of lead may be safely used when fruit is immature.**

FOR CODLING MOTH **(causing wormy apples): Spray with Arsenate of Bordeaux as soon as the blossoms fall and again 10 days later, P. 28. For Second brood spray in August, P. 30.**

FOR APPLE SCAB: **Spray with Bordeaux mixture, combined with arsenate of lead as above.**

FOR SHOT HOLE FUNGUS AND MILDEW ON CHERRY AND PLUM: **Bordeaux early and late.**

For **"damping" of plants in seed-bed or hot-bed use "Liver of Sulphur", P. 12.**

NOTICE. **When "lime" is mentioned in this bulletin, fresh, unslaked or quick lime is meant. Never use slaked lime in the preparation of spraying mixtures.**

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Introduction

The purpose of this bulletin is to provide in a concise and convenient form, formulas and directions for preparing the standard spraying mixtures.

These and the accompanying suggestions have been gleaned from different sources, largely Experiment Station literature, which embody the results of many careful experiments.

Brief discussions of the reasons for spraying with partial descriptions of the common insects and diseases affecting tree fruits in Wisconsin will be found in Part II. These have also been compiled from various sources mainly "The Spraying of Plants" by Lodeman. This book and the three following by Weed should be consulted by everyone who has ten acres or more of fruit.

"SPRAYING CROPS."
"INSECTS AND INSECTICIDES."
"FUNGI AND FUNGICIDES."

Any of the books mentioned here may be had from the Orange Judd Co., New York City, or will be ordered by any bookdealer.

Persons receiving this bulletin are urged to preserve it for future reference.

FREDERIC CRANEFIELD.
Editor.

PART I.

FORMULAS

INSECTICIDES.

> "Any substance which is used to destroy or repel insects may be termed an insecticide; and any substance which destroys fungi, or which prevents their injurious growth on vegetation, a fungicide. No substance, so far as known, will answer both purposes equally well."—Lodeman.

No extended list of formulas will be given in the following pages. In fact, out of the long list of remedies published from time to time but two insecticides and one fungicide are now recognized as standard remedies, viz., an arsenical poison for biting insects, kerosene emulsion for sucking insects and some form of copper for fungi.

INSECTICIDES.

(For biting insects.)

PARIS GREEN.

Paris green	1 to 2 lbs.
Fresh (unslaked) lime	1 lb.
Water	200 gallons

Paris green is heavier than water and the mixture must be kept in constant motion during spraying operations to prevent settling.

It is often adulterated.

*"The purity of a sample of Paris green can not be known with certainty without the making of a chemical analysis. There are, however, a few simple tests by which its quality may be fairly well determined by the orchardist.

The color should be a beautiful clear green. Adulterations sometimes give it a faded or dull appearance.

A good quality of Paris green dissolves completely in Ammonia water."

Gypsum and slaked lime are two adulterants commonly used.

Paris green if used on growing plants greatly in excess of the above formula may injure the foliage. The addition of the lime overcomes the caustic properties and renders it safe under all conditions.

Dry Paris green may be used pure if applied in small quantities. Different "Dry powder guns" have been invented for this purpose.

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* Bull. 120 Ill. Exp. Sta.

While Paris green, if pure, is a valuable insecticide, it is being rapidly displaced in orchard spraying by arsenate of lead.

ARSENATE OF LEAD.

(A poison for biting insects.)

Formula.

Arsenate of lead	2 to 3 lbs.
Water	50 gallons

Arsenate of lead is a combination of arsenate of soda and sugar of lead. Several firms now offer this valuable insecticide prepared ready for use. See page 29.

Arsenate of lead may be used in any reasonable quantity without danger of injury to foliage.

It remains in suspension longer than Paris green.

It adheres better to foliage; has remained on foliage from June to September in sufficient strength to kill web-worms.*

It may be used for any purpose for which Paris green is employed in liquid sprays. Arsenate of lead has been used in spraying the Wausau orchard the past five seasons with perfect satisfaction and is being used and highly recommended by several Wisconsin fruit growers.

When a large quantity of arsenate of lead is needed the cost may probably be reduced by using a home-made compound. The difficulty lies in the possibility of securing materials of high grade. For those who wish to attempt it the following from Bull. 120, Ill. Agr. Exp. Sta. will be helpful.

"Arsenate of lead is prepared for spraying in the following manner: Use

10 ounces arsenate of soda,
25 ounces acetate of lead,
50 gallons of water.

Dissolve the 10 ounces arsenate of soda in 1 gallon of water and 25 ounces acetate of lead in 2 gallons of water. Pour the two solutions, one after the other, into a mixing tank, or directly into the spray tank, containing 47 gallons of water. Stir thoroughly to insure a perfect combination of the two chemicals. The white precipitate which forms when the two solutions combine in the water is a mixture of arsenate of lead and other compounds formed when the two chemicals unite."

A remedy for the potato beetle, codling moth and other biting insects. Commonly used with Bordeaux mixture.

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* Bull. 213 N. J.

WHITE HELLEBORE.

(For biting insects.)

Powdered white hellebore is commonly employed to destroy currant and cabbage worms and on fruits and vegetables where more poisonous substances cannot be used with safety.

Formula.

White hellebore	1 oz.
Water	2 to 3 gallons

It may also be used dry either alone or mixed with flour, land plaster, soot, etc.

White hellebore is scarcely poisonous to the higher animals and may be used freely on fruits and vegetables when these are at any stage of maturity.

ARSENITE OF LIME.

This is a combination of white arsenic and lime. If properly prepared it may be safely used, especially when combined with Bordeaux mixture, and costs considerably less than either Paris green or arsenate of lead.

It must be kept in mind that free or water soluble arsenious acid, white arsenic, is very destructive to growing plants and in making arsenite of lime sufficient lime should be used to effect a perfect combination.

The following formula and directions are taken from Bulletin 213, N. J. Exp. Sta.

ARSENITE OF LIME.

White arsenic	1 lb.
Fresh lime	2 lbs.

*"Slake the lime and arsenic together with just water enough to form a smooth paste, stirring while the process is going on so as to form a perfect mixture. This mixture may be used at the rate of one pound of the arsenic to 300 gallons of water, or Bordeaux mixture.

"By boiling 1 pound of white arsenic and 2 pounds of lime in 2 gallons of water forty minutes, a more perfect combination of the materials is obtained, which may be used at the same rate as above."

ARSENITE OF SODA.

White arsenic	1 lb.
Sal soda	4 lbs.
Rain water	1 gallon

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*Bull. 213 N. J. Agr. Exp. Sta.

Boil the arsenic and soda in the soft water for from 15 to 30 minutes, until the arsenic dissolves. To prepare for use slake 2 pounds of lime in 2 gallons of water and add one pint of the arsenite of soda. When thoroughly mixed add water to make 40 gallons. Never use the arsenite of soda without lime.

If combined with Bordeaux an excess of lime should be used in preparing the Bordeaux.

While these home-made preparations are effective and cheaper than the commercially prepared poisons great care is needed in preparation and an error might easily cost more in burned foliage and loss of crop than the extra cost involved in the use of either Paris green or commercial arsenate of lead. The latter is recommended for spraying fruit trees.

KEROSENE EMULSION.

(For sucking insects.)

Used only to destroy sucking insects. It must be applied to the insects and cannot be used as a preventive.

This is the standard remedy for sucking insects.

Formula.

Dissolve 1 lb. hard soap in 2 gallons of boiling water.

While hot add 2 quarts kerosene.

Churn or shake the mixture while hot for 5 to 10 minutes or until it assumes a creamy consistency.

Add 6 gallons of water before using.

Another plan consists in using sour milk instead of the soap water, the object in either case being to hold the kerosene in suspension while it is applied to the insects.

The most approved method of applying kerosene is by means of a special pump designed to mix kerosene and water. These pumps are made by different firms in various sizes from a hand pump or syringe which may be had for 75 cents, to a barrel pump costing $20.00. This is the cheapest, most agreeable and by all means the best method of applying kerosene.

LIME-SULPHUR COMPOUND.

A preparation of lime and sulphur combined by boiling and first used as a sheep-dip in California, has come to be recognized as an effective remedy for the San Jose scale and other armored scale insects.

Formula.

Fresh (unslaked) lime	15 lbs.
Flowers of sulphur	15 lbs.
Water	50 gallons

Directions for preparation:*—"In a kettle of at least 40 gallons capacity heat 12 gallons of water. In a separate vessel mix 15 pounds of sulphur with water enough to make à thin paste. Pour the paste into the heated water and when the mixture is near the boiling point add 15 pounds of lime. After the lime has completely slaked, boil for one hour, stirring to prevent caking on the sides of the kettle. Then strain into the spray tank (or barrel) and add sufficient water to make 50 gallons of the mixture."

Lime-sulphur wash diluted as above is used only on dormant plants. Where large quantities are used a steam cooking plant is almost a necessity.

Lime-sulphur compound is now offered for sale by different firms. See page 29.

There are many advantages in using the commercial lime sulphur although the cost will be considerably more than that of the home-made article. The commercial product is a clear reddish liquid and is used by diluting with cold water at the rate of one to eight or one to eleven, the latter being the proportion recommended by the manufacturers.

Like the home-made mixture it can be used only as a winter spray.

The lime-sulphur wash probably possesses considerable value as a fungicide also and it has been used to some extent as a summer spray at a dilution of one to twenty-five or one to thirty and the addition of 6 pounds of fresh lime to each 50 gallons of mixture as a substitute for Bordeaux mixture.

Further trials, however, are needed to demonstrate its value and the strength at which it can be used with safety.

FUNGICIDES.

The control of fungous diseases is accomplished by the use of some form of copper salts, usually copper sulfate, known also as blue-stone, blue vitriol, etc.

Copper sulfate may be used on dormant plants when dissolved in water at the rate of 2 pounds to 50 gallons of water, but *this solution must not be used on growing plants.*

Copper sulphate in combination with fresh lime forms the standard and well known fungicide Bordeaux mixture.

Various formulas are quoted, but the following is now accepted as safe and reliable:

Copper sulfate	4 lbs.
Fresh lime	5 lbs.
Water	50 gallons

In general terms, the copper sulfate should be dissolved in one-half of the water, the lime slaked in the remainder and the two solutions poured together. This results in a chemical action giving rise to a new substance preserving the fungicidal properties of the copper sulfate and if properly made will not injure foliage.

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* Bull. 120 Ill. Agr. Exp. Sta.

Bordeaux mixture is used as a *preventive* of apple scab, asparagus rust, mildew on grapes, roses and other plants, potato blight and rot, shot-hole fungus on plum and cherry and other fungous diseases.

Helpful Hints in Making Bordeaux Mixture.

(1) Have on hand three barrels and two pails (wood or fiber.)

(2) Twenty-five gallons of water in each of two of the barrels.

(3) Dissolve 4 pounds of copper sulfate in one barrel by suspending in a coarse burlap as near the surface of the water as possible; in this way it will dissolve in a few minutes, while if allowed to settle to the bottom it would require several hours to dissolve.

(4) Place the lime in a pail and slake by adding water slowly until a paste is formed. (The lime for Bordeaux mixture should be slaked exactly as for building purposes.)

(5) Pour this lime paste into the second barrel and stir thoroughly.

(6) Add the required amount of arsenate of lead to the lime water.

(7) Now pour into the third (empty) barrel first a pailful of the copper sulfate solution then a pailful of the lime water, or better, let two persons work at the job, pouring together.

(8) The resultant mixture should be of an intense blue color. If any tinge of green appears it is not good Bordeaux mixture.

(9) The lime-water should be strained to remove the coarse particles which serve to clog the nozzles in spraying.

(10) Sufficient lime must be used to combine with all of the sulfate or harm will result. The formula given above provides an excess, but such excess is preferable to a slight deficiency. Use all of the lime water.

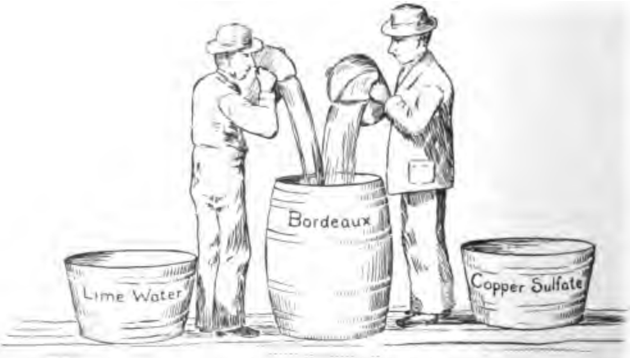

FIG. 1. Illustrating method of making Bordeaux mixture. Adapted from Farmers' Bulletin No. 38, U. S. Dept. of Agr. B. T. Galloway, author.

(11) Test the mixture. It is always advisable to test every barrel of the mixture before using to detect the presence of any free or uncombined copper which might injure foliage.

Test No. I.

Dip a bright, clean steel knife blade into the prepared Bordeaux mixture; if any, even the slightest, deposit of copper appears on the blade after a few moments' exposure to the air it is an indication that more lime is needed.

The knife blade should be thoroughly whetted before using for a second test. While this is simple and fairly reliable,

Test No. II,

or the ferro-cyanide of potassium test is more accurate.

Ferro-cyanide of potassium may be purchased at any drug store.

Place a small quantity (1 oz.) in a bottle and add water slowly until nearly all of the yellow crystals are dissolved. Stir the Bordeaux thoroughly and dip out a few ounces in a saucer. Add a few drops of the ferro-cyanide solution; if any brown discoloration appears it is an indication that more lime is needed. This is a delicate and reliable test.

The ferro-cyanide is a violent poison and should be labeled as such.

Three Things to Avoid in Making Bordeaux Mixture.

(1) Do not use iron or steel vessels for the sulfate or Bordeaux. Not only will these be corroded but the chemical action resulting from continued contact may injuriously affect the mixture. Tinned or galvanized pails are unsafe, as the zinc or tin coating is apt to be imperfect. Use only wood, copper, earthenware or glass.

(2) Do not dissolve the sulfate and lime each in 2 to 4 gallons of water as formerly recommended and then mix the concentrated solutions; curdling will result and after dilution difficulty will be experienced in keeping the Bordeaux in suspension.

(3) Do not fail to stir the ingredients while mixing and the resultant mixture when spraying. If allowed to settle the only portion possessing fungicidal value quickly settles.

Keeping Qualities of Bordeaux Mixture.

Reports are on record of the use of Bordeaux mixture several days after mixing with no injurious results, but it is generally agreed that for perfect safety it should be used only when fresh. The expense of a barrel of the mixture is too slight and tne chances of injury too great to warrant using Bordeaux that has been made more than 24 hours.

The Use of Stock Solutions in Preparing Bordeaux Mixture.

If more than one barrel of Bordeaux is required much time may be saved by using stock solutions.

Dissolve 100 pounds, for example, of copper sulfate in 50 gallons of water by suspending in a coarse sack as advised above; slake 100 pounds of lime in another vessel and dilute to 50 gallons; two gallons from the sulfate solution and two and one-half gallons from the lime solution will then contain the requisite amount of ingredients for one barrel of Bordeaux.

Such a stock solution may be kept indefinitely if covered, otherwise the evaporation of water from the sulfate solution would result in a more concentrated mixture and the lime would deteriorate. The lime may be covered with water.

The Bordeaux should be tested when made from stock solutions as when made direct.

This method of using stock solutions is now employed in all extensive spraying operations. In cases where large quantities of spray material is used elevated tanks should be employed from which the solution may be drawn directly into the spray barrel or tank.

POTASSIUM SULPHIDE.

(Liver of Sulfur.)

For checking the spread of certain surface feeding fungi, as gooseberry mildew, grape mildew, rose mildew and many of the fungi which cause "damping" of young plants in the seed bed, potassium sulphide may be used to excellent advantage.

Formula.

Potassium sulphide	4 ounces
Water	10 gallons

The solution must be used as soon as made, as it quickly loses its strength.

Any unused portion of the potassium sulphide should be kept in a tightly corked bottle to prevent loss of strength.

COMBINING INSECTICIDES AND FUNGICIDES.

Either arsenate of lead or Paris green may be safely combined with Bordeaux mixture. In fact, in all orchard spraying operations it has come to be a common practice to add either Paris green or arsenate of lead to Bordeaux at every application. By this means biting insects and fungi are controlled at a single operation. No other fact is more important than this in spraying.

When using arsenate of lead with Bordeaux always add the arsenate to the lime water, instead of pouring it into the combined copper sulfate and lime; this is important.

Other combinations than the above have been attempted, but with only slight success, as combining kerosene emulsion and Bordeaux; kerosene emulsion and Paris green, etc.

SPRAYING MACHINERY.

The application of spray mixtures necessitates the use of some sort of force pump. Spray pumps and machinery may be divided as follows on the basis of efficiency:

(1) Syringes, atomizers and other like devices known as "hand" sprayers, used to spray house plants and small plants in the garden.

(2) Pumps or devices adapted for small gardens where a few currant bushes, small trees, etc., are grown.

(3) Pumps for general orchard and field work and the spraying of shade trees under fifty feet in height.

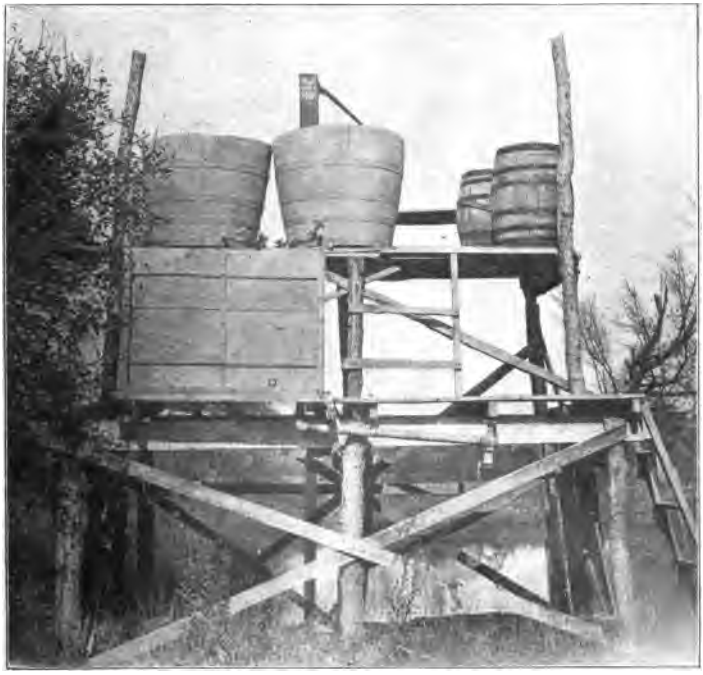

FIG. 2. "Spray mixing outfit of good design. Note the following features: Barrels for concentrated lime and copper sulphate solutions, tubs for dilute mixtures, and vat for mixing; also pump at rear to draw water from spray pond. This outfit lacks elevated supply tank and storage shed." Illustration and legend from Circular 120 Illinois Agr. Exp. Sta.

(4) Large pumps operated by gasoline or other power and adapted to any class of work, but designed especially for extensive orchard and park work.

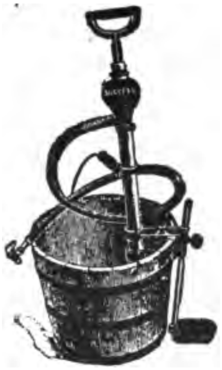

FIG. 3. Bucket spray pump.

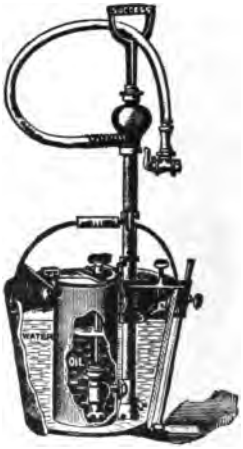

FIG. 4. Bucket pump with kerosene attachment. The "Success" pumps figured here are made by the Deming Co., Salem, Ohio.

The average Wisconsin farmer or orchardist will seek for a pump in either the second or third class.

In addition to these many machines adapted to special lines of work are offered for sale, as potato sprayers, etc.

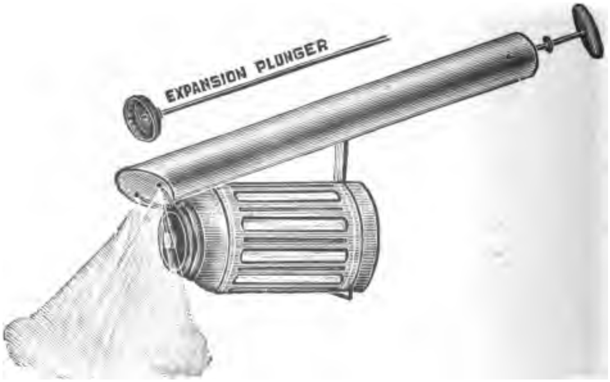

FIG. 5. Hand sprayer, valuable principally in the flower garden.

(1) The cheapest and simplest of efficient pumps may be found in the first class, viz., "hand" sprayers or atomizers. These sell for $1.00 to $2.00 and some are very efficient little sprayers. Their use-

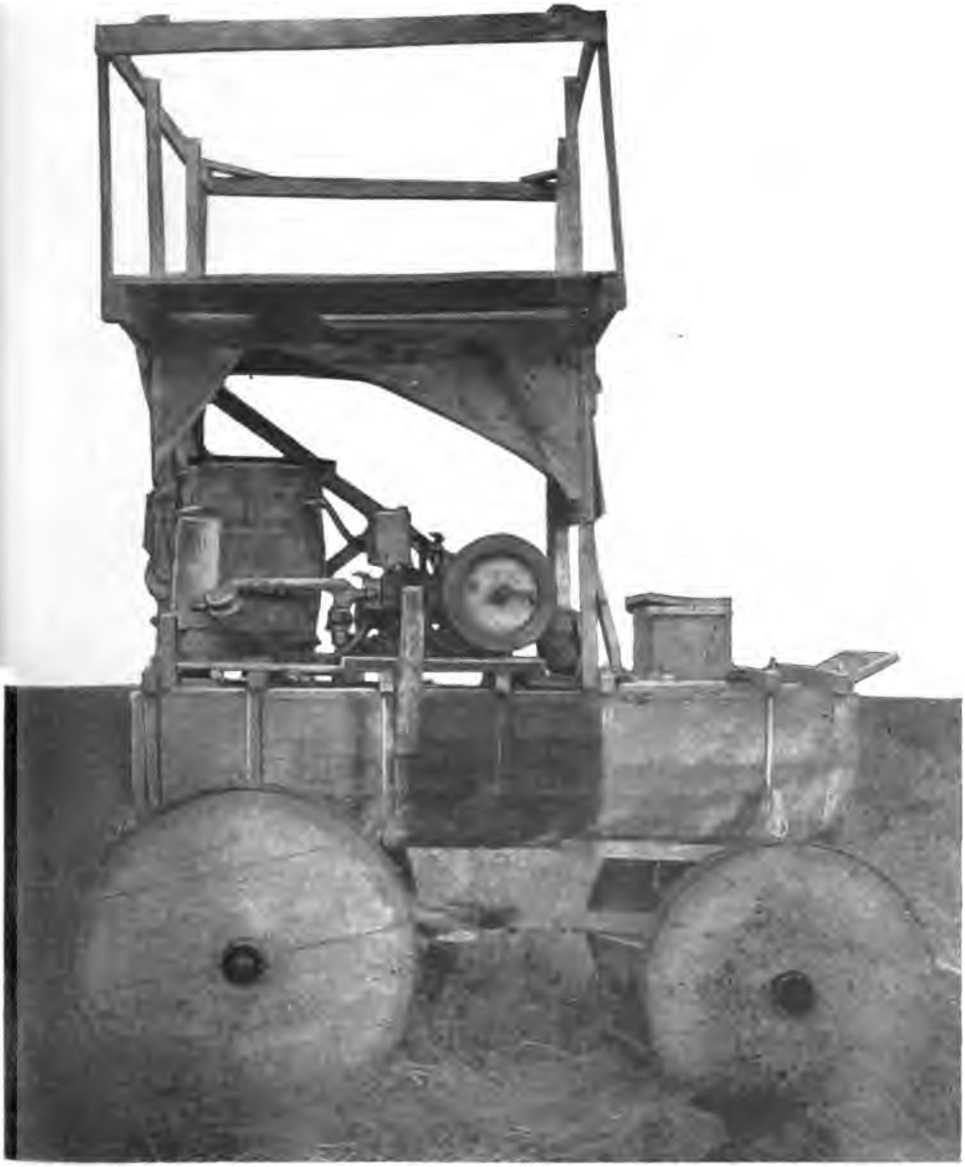

FIG. 6. "A gasoline power spray outfit with tower attached. Note curtain for protection of the engine and the pump (raised to show machinery), and broad-rimmed wheels boxed in to prevent the accumulation of mud inside the tires." From Circular 120 Ill. Agr. Exp. Sta.

fulness, however, is confined to a very narrow field on account of the limited capacity for fluids and the very short distance sprays can be thrown.

(2) In this class are bucket and knapsack pumps and of these the bucket pump is to be preferred. Trees 10 to 15 feet in height may be sprayed with a bucket pump, also bushes, vines, etc. On some kinds a kerosene attachment is provided (Fig. 3), by means of which a mechanical mixture of kerosene and water may be applied to destroy sucking insects. Where but a few young trees, bushes, etc., are to be sprayed a bucket pump will answer all purposes, but for orchard work the time employed in refilling the bucket and in transporting the pump and mixture will more than offset the increased cost of a larger pump.

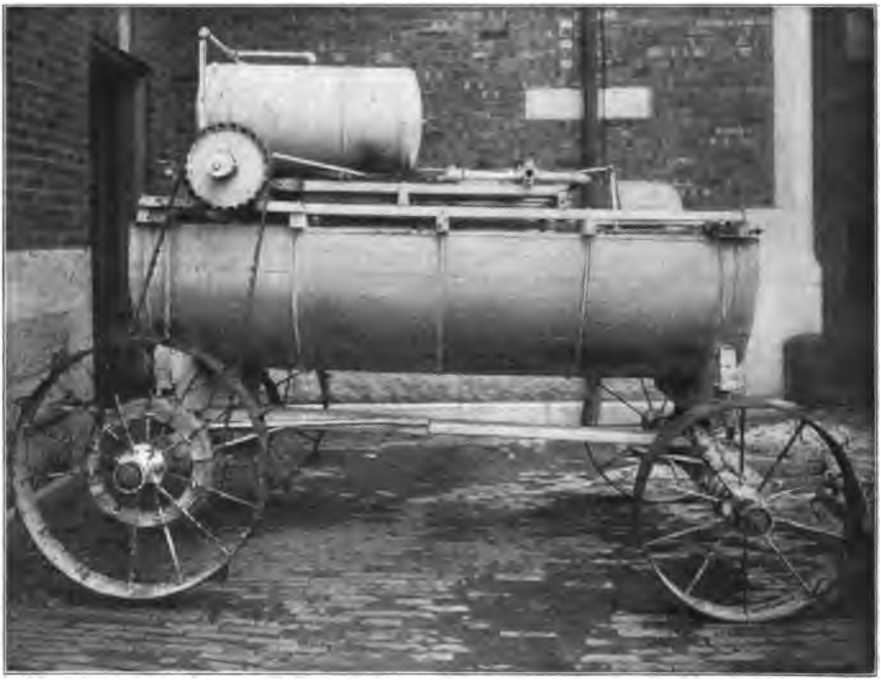

FIG. 7. "Geared power sprayer. Power derived from hind axle of spray wagon. An excellent type for use in young orchards of large acreage." From Circular 120 Ill. Agr. Exp. Sta.

(3) In this class are the various barrel pumps. These are operated by hand and designed to be fitted to an ordinary barrel (Fig. 13.) This is the most popular kind of pump and it is probable that more

of these are used in Wisconsin than any other kind. While primarily designed to be used in a barrel, these may be fitted to a tank or other receptacle.

With pumps as with other machinery, the best is usually the cheapest in the end. Do not expect to get a serviceable pump for a low price. The best pumps have all working parts, valves, plungers and cylinder, of brass. A pump that retails for three or four dollars may be of some service in washing windows or carriages, but is of slight value in spraying.

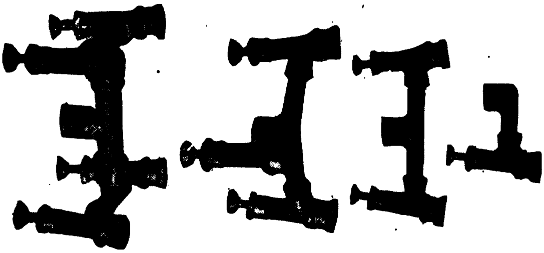

FIG. 8. Clusters of Vermorel nozzles.

Nozzles.

No matter how efficient the pump, good work cannot be accomplished without good nozzles. Many kinds are offered for sale, but of the multitude of forms but two types are in common use. These are represented by "Bordeaux" and "Vermorel."

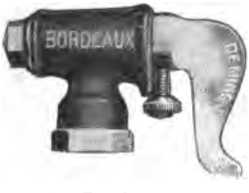

FIG. 9. Bordeaux nozzle.

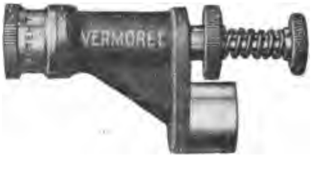

FIG. 10. Vermorel nozzle.

In the former the spray is formed by the fluid being forced against metal obstructions after it leaves the nozzle proper; in the latter a rotary motion is given it within the nozzle, breaking the fluid into extremely fine particles before it leaves the nozzle.

The "Bordeaux" is adapted for use where the spray must be thrown several feet and in windy weather, but it cannot be gradu-

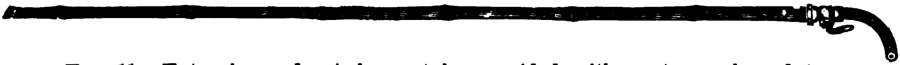

FIG. 11. Extension rod. A brass tube provided with a stop-cock and inserted within a bamboo pole.

ated to produce as fine a spray as the "Vermorel" and is not, therefore, as economical of material as the latter. As nozzles are not a large item of expense in a spraying outfit it is well to have both kinds at hand.

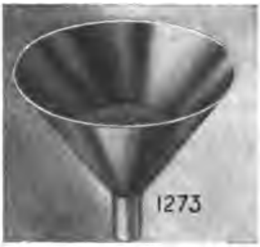

FIG. 12. Strainer.

Extension rods.—In spraying large trees(these are almost a necessity, as by means of a rod (Fig. 11) the spray may be directed to the inside of the tree, which could not be reached without it except with great loss of material.

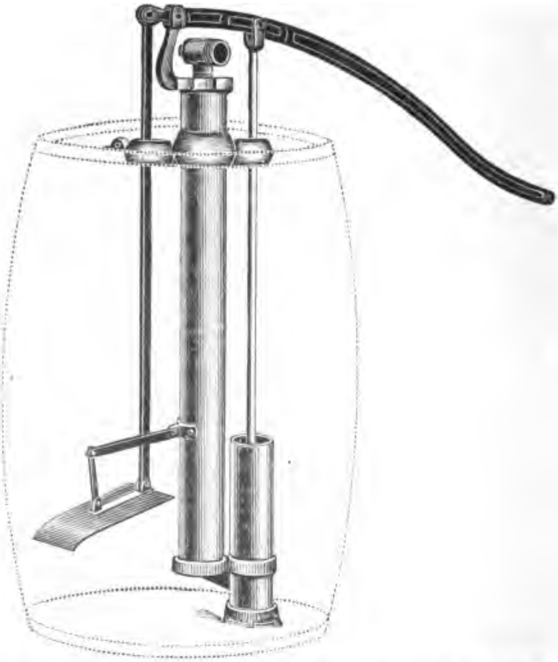

FIG. 13. A good hand pump for orchard work; may be used either in a barrel or tank.

A gallon measure made of copper is convenient but not necessary.

A strainer of some sort is always needed to remove coarse particles of lime, etc. (Fig. 12). Burlap should never be used for straining on account of the loose fibers or thread which pass into the strained mixture.

A large copper funnel with a wire gauze strainer is better than burlap. Hose, nozzles, strainers, rods, etc., may be purchased of firms furnishing spray pumps.

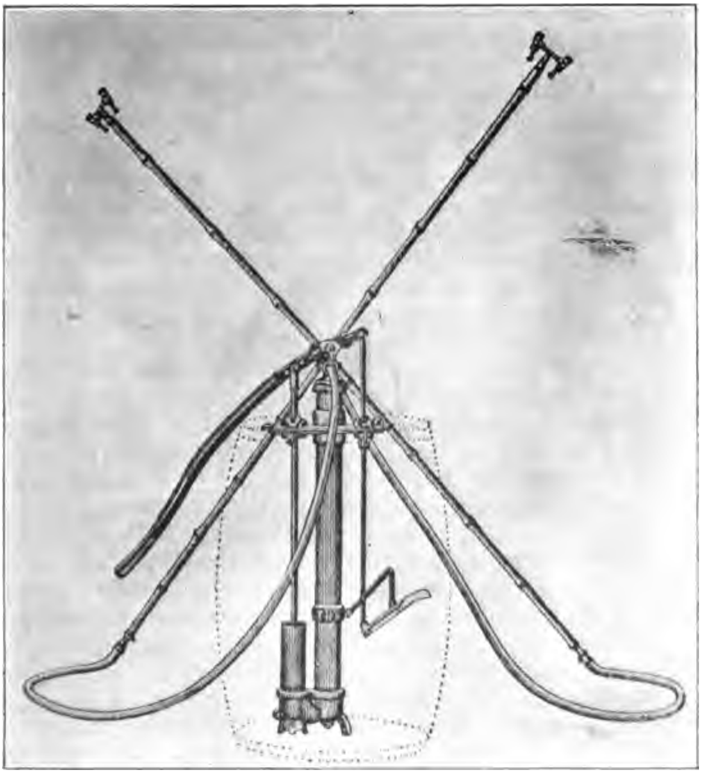

Fig. 14. An efficient pump equipped with two leads of hose, extension rods and Vermorel nozzles.

PART II.

SPRAYING

The successful culture of fruit demands a knowledge of tillage, fertilizing, pruning and the methods of combating insects and diseases.

It is mainly the lack of acquirement of knowledge concerning the enemies of the crop that distinguishes the successful from the unsuccessful fruit-grower.

Animal husbandry demands skill in feeding and the general care of animals, but diseases as a rule are left to the veterinarian, but when our fruit trees are affected we must be our own doctor.

Trees may be totally neglected after planting and eventually give some sort of returns, but such practice is not worth while. If fruit trees and plants cannot be properly tended none should be planted, for the results will be disappointing.

Two classes of enemies attack fruit trees and plants, viz.: insects and fungous diseases; the application of substances, usually liquid, to the tree or plant for the purpose of preventing or destroying these constitutes spraying.

We spray to *destroy* insects and to *prevent* fungous diseases. Spraying is no longer an experiment. It is an established fact that intelligent and persistent spraying always pays.

The effects of spraying are cumulative. The effects of spraying last year and this year may result in an increased yield next year.

Spraying is not an exact science; we may and indeed should modify methods and formulas to suit conditions. The beginner need not fear that his trees will be ruined by lack of knowledge relating to the full and exact methods of preparing formulas, for only by gross carelessness or utter disregard of simple directions could such results occur.

Certain points, however, should always be observed. Three of these are so clearly stated by Lodeman* that they are given here verbatim.

"*First, be on time.* Make an application when it will do the most good, and never allow that time to pass if it can possibly be avoided. Every delay is of advantage to the parasite, and it will be used so well that in most cases the injury cannot be repaired. The destruction of one insect may mean the destruction of hundreds, and one application made at the right time may mean, and generally does mean, the protection of a plant against millions of spores of fungi which are endeavoring to gain a foothold. Be ready for action at a moment's notice, and when that moment comes, spray!

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* The Spraying of Plants. Lodeman. P. 226. Published by the Macmillan Co., 66 Fifth Ave., N. Y. Copyrighted.

"*Second, be thorough.* When spraying a plant, spray it well. With a little care, a complete success may be obtained instead of only a partial one. When the work is finished, the grower should have the feeling that it is well done, and then no fear as to the result need be entertained. Spraying is not always pleasant work, and the temptation to slight it is often strong; but the operator will be rewarded just to the extent to which he has been painstaking, and to that extent only.

"*Third, apply sprays intelligently.* This is really the most important factor of the work, although good crops can be obtained without it, provided directions are followed. The first two points cannot be neglected without injury to the crop, but this one can be. The crop is in need of the applications only, but the grower should know the reasons for them, and should be in a position to modify his treatments so as to make them conform with the character of the insect or the disease which is being treated, and with the season. Every year and every day such knowledge will be of value. So many things are still unknown, and so many points still in dispute, that personal knowledge and judgment about individual cases are not only desirable, but very essential. Directions covering the majority of cases can be given, but now and then one will come up which seems to differ from all others, and it is then that this knowledge will prove most valuable."

In order to derive the best results from spraying we need a knowledge of the life history of the insects and diseases commonly affecting our plants.

In a publication of this nature it is manifestly impossible to enter into a wide discussion of these subjects. Several excellent books have been published which present the subject in full. A perusal of one or more of these supplemented by close observation will be helpful.

An acquaintance with certain elementary facts, however, is essential to any intelligent work in spraying.

THE TRANSFORMATION OF AN INSECT.*

"To fight an insect intelligently one must know its life history. There are certain periods in its life when it is vunerable and others when it is protected. This change of conditions is largely due to the fact that most insects in the course of their lives undergo a great many changes of form; they undergo a "*transformation.*"

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* Prepared by request, by C. E. Bues.

Mostly the various stages of this transformation look so different that if we did not know, we would set them down as different animals. Thus we have insects with a *complete "metamorphosis,"* which comprises four stages, and those with an incomplete metamorphosis with less stages. The stages of one of the higher insects with a complete metamorphosis being known, we can infer the corresponding stages of most of the lower forms.

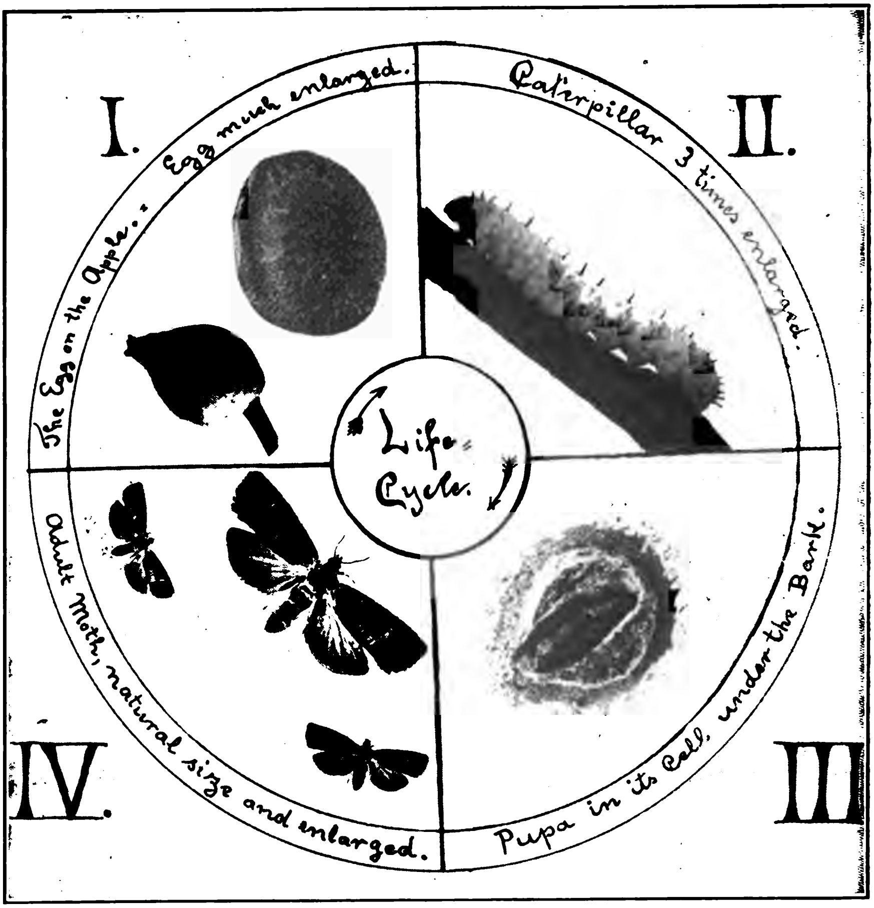
I.
The Egg on the Apple. Egg much enlarged.
II.
Caterpillar 3 times enlarged.
III
Pupa in its cell, under the Bark.
IV.
Adult Moth, natural size and enlarged.
Life Cycle.

FIG. 15. Life cycle of codling-moth. Prepared by C. E. Bues from photographs furnished by Prof. M. V. Slingerland.

As an illustration the four stages of one of the most destructive, and yet by most people little known, insects, the *codling-moth,* which in one stage is the "apple worm," are here placed in the form of a life cycle.

I. *The egg* is laid on the apple.

II. From the egg hatches the *caterpillar* or apple worm, which eats its way through the blossom end into the apple. *This is the only stage in which the insect grows.*

III. The caterpillar has changed to a *pupa, a resting stage,* under the bark of the tree.

IV. Out of the pupa emerges the *moth,* the *adult* insect. In this stage reproduction takes place and we begin our cycle over again with the egg.

To these insects which go through these four stages belong the butterflies, beetles, bees and flies. Some insects lack the resting or pupa stage, and the young, when hatched, resemble the adult to some extent. These are insects with an *incomplete metamorphosis."*

The insects affecting fruit may be divided for convenience into two classes, which are distinguished by their mode of feeding, viz., eating or chewing insects and sucking insects.

Eating insects consume the affected tissues, commonly the leaves, and thereby hinder the functions of the plant. Common examples are the potato "bug" or beetle; the currant worm which defoliates currant and gooseberry bushes twice in the season; the larva of the codling-moth, which causes wormy apples; the plum curculio; the tent caterpillar and others.

Insects of this class are destroyed by poisoning their food. The parts of the affected plants consumed are covered with a poisonous substance which is eaten with the plant tissues, causing death. Insects that eat only the foliage are easily destroyed and should cause no great concern. Usually a single application of Paris green or arsenate of lead is sufficient. Insects that attack the fruit are more difficult to control.

Sucking insects do not consume the external tissues of the plant but feed only on the sap. In order to accomplish this the insect trusts its proboscis through the external coverings and sucks the juices in the same way a mosquito sucks blood. As these insects do not consume the tissues of the leaf or branch poisons are of no avail. Even if the surface be thickly covered with a layer of poison the aphis will thrust its beak through it as well as through the epidermis of the leaf to reach the plant juices beneath. We must therefore attack the insects. This is done by covering them with some caustic substance which will penetrate their bodies or with an oily substance which closes their breathing pores.

Sucking insects cause less damage in Wisconsin at present than biting insects. To the class of sucking insects belong the numerous aphidæ or plant "lice," which attack the young growing shoots of fruit trees, roses, etc. Occasionally nursery stock is injured to some extent by aphids and plum trees are sometimes checked in their growth, but on the whole the injury is slight. Use kerosene emulsion, whale oil soap solution or common soap solution.

To repeat:

(1) Biting or chewing insects are destroyed by placing poison on the parts on which the insects feed.

(2) Sucking insects are destroyed only by attacking the insects and for this class poisons are of no avail.

Plant Diseases.

Apple scab, brown rot of plums and peaches, potato rot, blight, rust and other destructive plant diseases are commonly ascribed to weather conditions. *Indirectly this is often true,* but *neither rain nor drought. nor any other atmospheric condition is ever directly the cause of plant diseases.*

*"Such diseases, as already indicated, are produced by minute plants. which never arise spontaneously, but always from some . . . reproductive form of a previously existing plant of the same species. But weather conditions may be favorable to the rapid development of these fungi, and so indirectly cause the disease."

Rainy weather, then, does not directly cause plum rot, but provides conditions favorable to the development of the fungus and probably unfavorable conditions for the development of the plum and its ability to resist the invasion of the disease.

WHAT IS A FUNGUS?

It is a plant; a plant without leaves, flowers, seeds or †chlorophyll. It cannot therefore prepare its own food, but must feed on other plants.

There are two classes of fungi; saprophytic, which live on decayed or decaying vegetable tissues; toadstools, mushrooms, etc., are examples of this class, and parasitic fungi, which exist on living plants or their fruits, absorbing the prepared nourishment. It is mainly the parasitic class which concerns the fruit grower, for it is this class which causes plant diseases.

Fungi are propagated by spores, minute bodies which may float in the air and are usually too small to be discerned singly without the aid of a compound microscope; collectively these form a dust-like substance as in bread mold, mildew, etc.

These spores alight on leaf or fruit and under favorable conditions of heat and moisture germinate, giving rise to thread-like projections (hyphæ) which penetrate the tissues of the plant. These root-like bodies multiply with great rapidity, feeding upon the juices of the affected plant, forming the *mycelium.*

After a time certain of the modified mycelium (conidia) grow to the surface and produce there spores which are again disseminated. This, in brief, is the life history of a fungous disease. Countless modifications occur with the different species; the spores of some sorts perish soon after dissemination, while others may survive for an indefinite period; some species give rise to two sets of spores, one of which is of brief existence, while the other may persist over winter, etc.

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* Weed, Fungi and Fungicides, p. 11.

† Chlorophyll is the green-colored substance found in flowering plants which enables them to change the crude food, i. e., minerals of the soil to nutritive material (plant tissues) that can be used by animals and plants.

The main fact to be borne in mind is this: The spores which may be present in innumerable numbers may be destroyed or their germination prevented by the application of certain substances known as fungicides *while existing as spores on the outside of plants,* but after the hyphæ have penetrated the tissues of the leaf, stem or root spraying is of no avail. In other words, *spraying for plant diseases must be wholly for prevention.*

Laboratory investigations appear to show that the spores of many common fungi are not destroyed by insecticides and that these are effective only in the short time intervening between germination and the entrance into the tissues of the plant by the hyphæ.

SPECIFIC DIRECTIONS.

The enumeration of the different species of insects and diseases which attack even our common fruits and vegetables can not be attempted in a bulletin. Therefore in conclusion only brief notes regarding apple scab and brown rot among diseases, and the codling-moth in insects will be given. *Members of this Society are privileged and requested to send to this office at any time specimens of insects or diseases for identification.* To insure safe arrival insects should be enclosed in a tin box or stout wooden box and leaves and twigs wrapped carefully in tissue and then in heavier paper.

APPLE SCAB.

This disease affects both foliage and fruit, appearing on the former as yellow spots which eventually spread and cause the leaves to fall prematurely. On the fruit it appears as rough brown areas, seriously injuring its keeping qualities and market value.

The spores of this disease live over winter, adhering to the buds and bark as well as the fallen leaves, germinating at the time the leaves start in the spring. It is evident then that the most important spraying for apple scab is in early spring before the buds open, that we may destroy or prevent the germination of the spores. For this spraying copper sulfate may be used dissolved in water at the rate of 2 pounds to 50 gallons.

The trees should be sprayed again as soon as possible after the blossoms have fallen and a third time ten days later. Bordeaux mixture should be used for these sprayings, combined with Paris green or arsenate of lead. *Do not use copper sulfate on growing trees or plants unless combined with lime.* Always use Paris green or arsenate of lead with the Bordeaux mixture (1/4 lb. Paris green or 3 lbs. arsenate to 50 gallons Bordeaux) when spraying bearing apple orchards and in this way combat both scab and codling-moth at one operation.

PLUM ROT; FRUIT ROT; BROWN ROT.

This destructive fungus is the most provoking as well as the most destructive of plum diseases. It usually affects the ripening fruit, causing it to decay rapidly while still on the tree. The skins of the affected fruits are covered with grayish postules or spore masses which serve to perpetuate the disease.

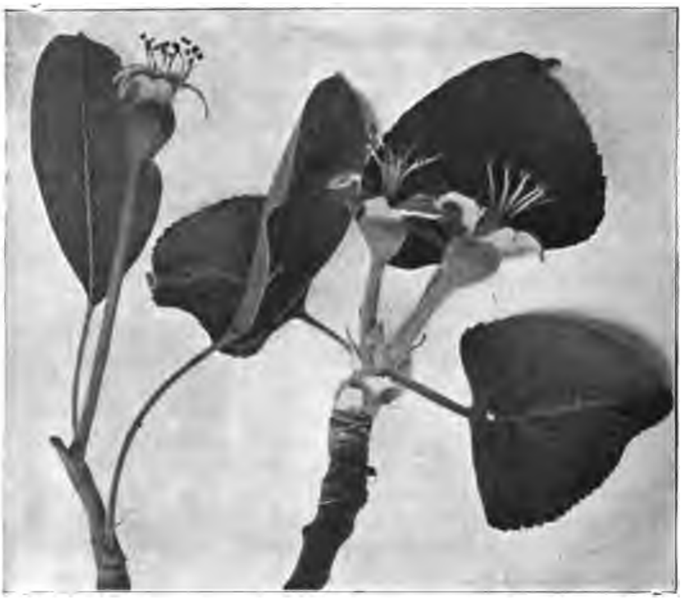

FIG. 16. "Just right to spray. A pear and two apples from which the petals have recently fallen. Note that the calyx lobes are widely spread." Illustration and legend copied from Bull. 142 Cornell Univ., N. Y. M. V. Slingerland, author.

The spores may gain entrance very early in the season, lodging in the bud scales and as the buds open find a congenial field in the growing tissues where they usually exist through the summer, finding their favorite feeding ground in the ripening fruit.

Occasionally, however, it does not wait so long but if the weather conditions are favorable, attacks the blossoms, causing them to decay and thus wholly prevent the setting of fruit.

Moist, warm weather favors the progress of the disease.

It is probable that this disease may be largely if not wholly controlled by spraying. The first spraying should be done very early in the spring, before the buds open and at this time the copper sulfate solution advised for apple scab may be used. At the close of the blossoming season a thorough application of Bordeaux should be given, and again later in the season if any suspicion exists that the evil has not been overcome.

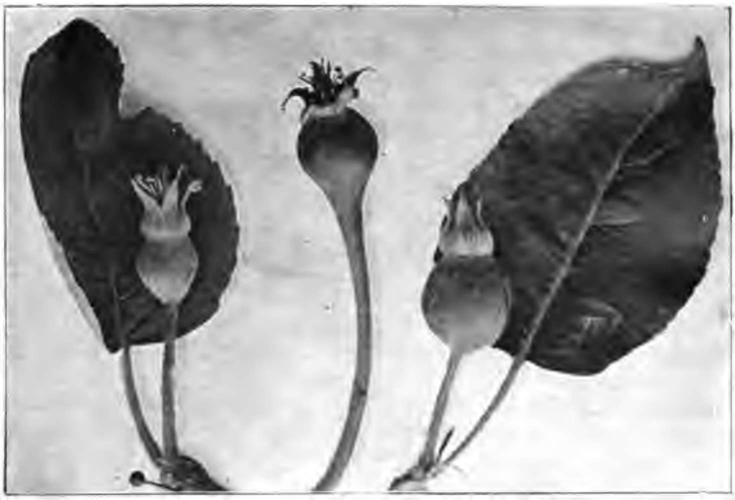

FIG. 17. "Almost to olate to spray apples effectively. Note that the calyx lobes are drawn nearly together, while on the pear in the center, the calyx-cavity is open." Illustration and legend as above.

Where the plums hang on the tree so thickly as to touch, they are apt to rot, as the moisture which collects at the points of contact produces a softening of the tissues which afford an opportunity for the germs to enter. It is advisable then to thin the fruit severely before ripening time.

CODLING-MOTH.

The mature insect, a night-flying moth, is rarely seen. The first brood appears about the time the blossoms open, arising from cocoons which may be found beneath the roughened bark of old trees or more commonly in the refuse on the ground in neglected orchards. The eggs are deposited soon after the blossoms fall, on the fruit and leaves. The eggs hatch in seven to ten days, and the larva or "worm" finds easy entrance to the interior of the apple at the calyx or blossom end. The remainder of the story is well known; wormy apples are exceedingly common in Wisconsin.

To successfully combat this pest, which in the early stages is a caterpillar scarcely one-sixteenth of an inch in length and which at once proceeds to the interior of the fruit, would seem a hopeless task and yet much may be accomplished by timely action.

For several days after the blossoms fall the immature apple retains an upright position on the stem with the calyx lobes spreading outward. This is the time to spray, and in common with practically all work of this kind must be preventive. The object to be attained in this spraying is to deposit a drop of poisoned water *in the calyx cavity* and to cover as far as possible the outside of the fruit as well as the leaves so that the caterpillar will be obliged to eat the poison in attempting to gain entrance.

After three or four weeks the calyx lobes close and later the little apples turn downward, rendering the proper application of poisons a difficult task. For further security a second application of the poison should be made in eight or ten days, as the egg laying extends over several days.

In case of heavy rains before the calyx closes, an additional spraying may be necessary. Theoretically, the later the poison is applied, the better, if done *before the calyx closes.* Rains after this period will do but little harm as the poison is protected by a roof formed by the calyx lobes.

The course outlined above would be sufficient to completely rid our orchards of the codling-moth in a short time if it were not for the

SECOND BROOD.

Many of the caterpillars of the first brood leave the apples at maturity and sheltered by crevices in the bark or in other secure places complete their transformation to emerge in July or August as moths; these again deposit eggs which enter the fruit when near maturity; therefore in order to insure apples wholly free from worms it will be necessary to spray at least once early in August, usually from the 10th to the 15th of the month, using Bordeaux combined with arsenate of lead or Paris green. The necessity for these later applications becomes more apparent and pressing with each succeeding year in Wisconsin orchards. A partial remedy consists in trapping by banding the trees. This consists of placing bands of burlap, cotton or even hay ropes about the trunks of the trees in June or July.

The larvae collect beneath these, which should be removed once a week and the caterpillars or pupas destroyed. A majority of the larvae leave the apples before they fall but many remain. While this method is of considerable value it is scarcely practical in large orchards. It is advisable, therefore, to collect and destroy all windfalls. By these means we may in a measure prevent the ravages of the second brood and materially reduce the crop of moths which would otherwise hibernate, but in no case should the early spraying be neglected, and if thoroughly done in proper season but little trouble will be experienced on account of the second brood.

Other biting insects which attack the apple are:

Canker worm and tent caterpillar.

Fortunately neither of the two named are common enough in Wisconsin to warrant an extended notice at this time; further, the spraying recommended for the codling-moth is sufficient to destroy either or both of these pests as they appear early in the season.

NOTICE.

The following lists are given for the convenience of our readers and have been compiled from advertisements in horticultural journals.

Nothing given herewith should be construed as a recommendation of any firm or machine.

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The Deming Co., Salem, Ohio.
R. H. Deyo & Co., Binghampton, N. Y.
The E. C. Brown Co., Rochester, N. Y.
Friend Mfg. Co., Gasport, N. Y.
Spraymotor Co., Buffalo, N. Y.
Wallace Machinery Co., Champaign, Ill.
Field Force Pump Co., Elmira, N. Y.
The Goulds Mfg. Co., Seneca Falls, N. Y.
Morrill & Morley Co., Benton Harbor, Mich.
F. E. Myers & Bro., Ashland, Ohio.
The New Way Motor Co., Lansing, Mich.

THE FOLLOWING FIRMS SELL ARSENATE OF LEAD.

Grasselli Chemical Co., Milwaukee.
Sherwin Williams Co., Pullman Sta., Chicago, Ill.
Merrimac Chemical Co., Boston, Mass.
Vreeland Chemical Co., Little Falls, N. J.

LIME-SULPHUR COMPOUND PREPARED READY FOR DILUTION WITH COLD WATER MAY BE HAD FROM THE FOLLOWING FIRMS:

Grasselli Chemical Co., Milwaukee.
The Rex Company, Omaha, Neb.

LET US (S)PRAY

WHAT?	WHY?	HOW?	WHEN?			REMARKS
			1ST SPRAYING	2D SPRAYING	3D SPRAYING	
Apple	Scab	Bordeaux Mixture	Just before Blossoms Open	Just after Blossoms Drop	10 days after 2d Spraying	
	Codling Moth	Arsenate of Lead combined with Bordeaux	Just after Blossoms Drop	10 days later	Last week of July or 1st week of August for 2d brood	1st and 2d Spraying same as 2d and 3d for scab; merely add arsenate of lead to Bordeaux
	Oyster Shell Scale	Lime-Sulphur	March or early April but before growth starts			Do not use Lime-sulphur on growing plants
Cherry and Plum	Mildew and Shot-hole fungus	Bordeaux Mixture, 3-4-50	When leaves are about $\frac{1}{3}$ grown	10 to 12 days later	10 to 12 days later	

Wisconsin State Horticultural Society

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WISCONSIN

State Horticultural Society

BULLETIN NO. 16

THE OYSTER-SHELL BARK LOUSE

MADISON, WIS., MAY, 1909

☞ The Bulletins and Annual Reports of This Society are sent free to members of the Society

CONTENTS IN BRIEF

For description and life history see P. 5-6

Cannot be destroyed by spraying with Paris Green, arsenate of lead or other arsenical poisons. See P. 7

Use Lime Sulphur before buds swell, in March or April. See P. 8

Do not use lime-sulphur on growing trees or plants.

Use kerosene emulsion when young lice are active. (June, 1st to 15th) when blossoms fall. See P. 7

INTRODUCTION

We are sometimes told that the numerous insects and diseases which seem to the superficial observer to be created for the sole purpose of harassing the fruit-grower and destroying his crops are really, like weeds, blessings in disguise.

Without attempting to pursue this line of thought to a conclusion it may be said that the San Jose scale and the Oyster-shell Bark Louse seem to be examples of so-called enemies which might serve to prove such an assumption.

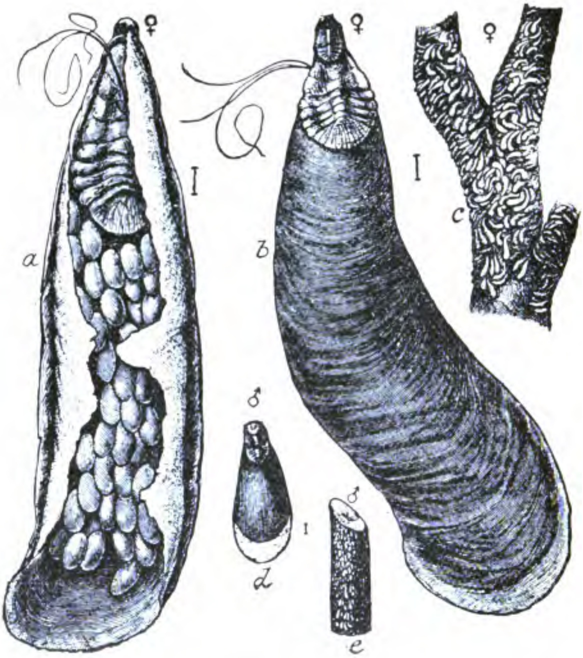
The Oyster-shell Bark Louse has been gaining headway steadily in Wisconsin orchards for over fifty years but has passed unnoticed in most cases until the advent of the San Jose scale and the consequent agitation respecting it.

Following several years of warning through bulletins and the press, owners of fruit trees have quite generally come to recognize the dangers from infestation by the San Jose scale, are looking for it, and in so doing discover the less dangerous but not to be despised Oyster-shell Bark Louse.

So numerous are the inquiries received at this office concerning this insect that the following concerning its life history and methods of control has been prepared as a convenient means of answering them.

The facts given herewith have been compiled from various sources, credit being given whenever possible.

FREDERIC CRANEFIELD,
Editor.



Oyster-shell scale (Lepidosaphes ulmi L.): *a*, Female scale from below showing eggs; *b*, same from above, greatly enlarged; *c*, female scales; *d*, male scale, enlarged; *e*, scale on twig, natural size. (After Dr. L. O. Howard, Year Book U. S. Dept. Agr., 1894.)

THE OYSTER-SHELL BARK LOUSE

This is not a newly discovered insect it having been described in a paper prepared for the Massachusetts Agricultural Society in 1794 and was no doubt well established in the New England colonies at that time.

According to Fitch it was introduced into Wisconsin at Kenosha in 1840.

''ORIGINAL HOME AND PRESENT DISTRIBUTION.—

''This is probably the commonest and most widespread, and consequently the best known, of any of the orchard scales. It is found all over the world. It was probably a European insect originally; at all events it was known in Europe during the last century; and was probably imported into this country on nursery stock by the early settlers. It is found in the United States practically wherever apples and pears are grown, more abundantly at the North than at the South.''—Howard in 1894 Yearbook, U. S. Dept. of Agriculture.

LIFE HISTORY AND APPEARANCE.

''It appears in the form of minute scales, about one-sixth of an inch long, of a brownish or grayish color, closely resembling that of the bark of the tree, and somewhat like the shell of an oyster in shape, adhering to the surface of the bark, and placed irregularly, most of them lengthwise of the limb or twig, with the smaller end upwards. In some instances the branches of apple-trees may be found literally covered and crowded with these scales; and where thus so prevalent they seriously impair the health and vigor of the tree, and sometimes cause its death.

Under each of these scales will be found a mass of eggs varying in number from fifteen or twenty to one hundred or more; these during the winter or early spring will be found to be white in color, but before hatching they change to a yellowish hue, soon after which the young insects appear. This usually occurs late in May or early in June, and, if the weather is cool, the young lice will remain several days under the scales before dispersing over the tree. As it becomes warmer, they leave their shelter, and may be seen running all over the twigs looking for suitable locations to which to attach themselves. A large proportion of them soon become fixed around the base of the side-shoots of the terminal twigs, where, inserting their tiny sharp beaks, they subsist upon the sap of the tree. Only one brood is produced annually in the North, the eggs remaining unchanged under the scale for about nine months.

"As the Oyster-shell Bark Louse retains power of motion only for a few days at most after hatching, it is mainly disseminated to distant places by the distribution of young trees from infested nurseries. In the orchard and its immediate neighborhood it may be spread by being carried on the feet of birds, or attached to the larger insects, or may be aided by the wind in passing from tree to tree, while it is itself so brisk in its active state that it can travel two or three inches in a minute, and hence might in this way reach a point two or three rods distant before it would perish. Although this insect essentially belongs to the apple-tree, it is frequently found on the pear, and sometimes on the plum and the currant bush."—Insects Injurious to Fruits. Saunders.

As will be seen later the time when the eggs hatch is an important factor in the control of this pest and the following will therefore be helpful:

"Dr. Mygatt in Illinois in 1854 laid down the rule that the hatching of the eggs began just following the time of the dropping of the petals from the apple blossoms. A rule of this kind is more reliable than the fixing of an arbitrary hatching date which is subject to deviation due to climatic conditions of the spring. Just before hatching the eggs turn to a pale-yellow color. The young lice upon hatching, crawl outward upon the twigs or settle upon fresh areas on the trunk and soon begin to secrete a white downy covering over themselves which after a few weeks becomes hardened and begins to assume the form and texture of the older scale. The males as adults are minute winged insects which are scarcely ever seen.

"Young twigs are more generally infested than older ones though this is not without exception, as for instance when whole trees become encrusted and killed. The forks of twigs or the points separating the last year's growth from that of the preceding are familiar points to find heavy infestation. The leaves and the fruit itself are occasionally infested."—Bulletin 18, Missouri State Fruit Exp. Sta.

REMEDIES

In order to attack this pest in a rational manner it is necessary to note the following points:

(1.) The Oyster-shell Bark Louse belongs to the class of sucking insects and subsists only on the sap of the plants which it infests and secures this food only by thrusting its beak through the skin or bark.

(2.) This being the case it is plain to be seen that arsenical poisons as used for foliage or bark-eating insects will be of no avail.

(3.) Sucking insects are most expeditiously destroyed by coating their bodies with some oily or caustic spray.

(4.) Soapy or oily sprays have been exclusively used until recently, applying at the time the young lice appear. (See extract from Missouri Bulletin for best season.) These are still standard and efficient remedies and should be used in all cases of bad infestation in addition to the dormant spray advised below.

Kerosene emulsion is cheap and wholly practical as the materials are always at hand or readily available. (See formula 9.) Spray thoroughly at season when young lice are active. This period of activity is limited to less than two weeks followed by the building of a scale or "armor" by each insect under which it may remain secure from attack until the time when the Lime-Sulphur can again be safely used. It is therefore necessary to watch closely, following the blossoming period, for the appearance of the young lice and to spray promptly with the kerosene emulsion.

(5.) The Oyster-shell Bark Louse has heretofore been considered almost invulnerable during the egg-laying and dormant period on account of its shell or "armor" which could not be penetrated or dissolved by any spray that would not also injure the bark.

It has been shown, however, by recent experiments, that the lime-sulphur wash used so successfully in destroying the San Jose scale, is efficient when used against the Oyster-shell Louse. The lime-sulphur should not be used on growing plants owing to its caustic properties. For the Bark Louse it may be applied at any time during the fall, winter or early spring before growth starts. A formula for preparation is given on P. 10.)

The following notes by Professor E. P. Sandsten, Nursery Inspector, are interesting and valuable:

"The scale insect is found in practically every orchard of the state, and in many cases is very destructive. The insect is especially partial to apple trees and seldom attacks cherries and plums.

"Since the insect obtains its food by sucking, it cannot be poisoned by Paris green or other arsenious poisons. Caustics and oils which will penetrate the scale or the skin of the insects may also be used."

"*Soap Suds.* One-half pound of common soap and one-quarter pound of washing soda dissolved in five gallons of boiling water; mix thoroughly and apply with spray pump.

"*Lime-Sulphur Wash.* Lime-sulphur wash is most readily prepared where there is access to a jet of steam or where facilities are handy for boiling the material. Unless steam is available, it is preferable to use the kerosene emulsion rather than the home-made sulphur wash, but where steam is available the latter insecticide may be readily prepared. The use of steam in preparing the kerosene emulsion also saves time in preparing the spray mixture. Commercial insecticide firms are now preparing the lime-sulphur wash and these mixtures are being tested by the Experiment Station. Judging from results thus far the commercial lime-sulphur wash will prove very effective. It should be applied while the trees are dormant. It should also be noted that there are upon the market spray pumps with kerosene attachments which spray kerosene and water directly by forcing the kerosene and water in intimate mixture through the nozzle. Kerosene and water mixture should be used only for winter spray."

FORMULAS AND DIRECTIONS

KEROSENE EMULSION.

Formula.

Dissolve one pound hard soap in two gallons of boiling water.

While hot add two quarts kerosene.

Churn and shake the mixture while hot for five to ten minutes or until it assumes a creamy consistency.

Add six gallons of water before using.

The following excellent directions are given in Bulletin 18, Missouri State Fruit Experiment Station, E. P. Taylor, Entomologist:

"Dissolve one-half pound soap in one gallon boiling water. While boiling hot add this to two gallons of kerosene and briskly agitate for about five minutes. A creamy mixture will be formed which, when diluted with water, will mix readily without allowing free oil to rise to the top. If the oil should separate the stock solution will have to be heated and agitated again. The usual precaution should be taken to avoid accidents in the handling of oil about an open fire. The essentials of success are in having the soapsuds boiling hot when the solution is added to the kerosene and in giving immediate and thorough agitation when the boiling soapsuds and kerosene are poured together. Usually this agitation is done by pumping the mixture back into the containing vessel.

"For use dilute with water to secure the desired percentage of oil."

In making kerosene emulsion the creamy mixture obtained by the first step should always be diluted with water before using. The usual dilution provides for six to seven per cent of kerosene. Professor Taylor's formula would then call for twenty-five to twenty-eight gallons of water.

The emulsion can only be used effectually against the Oyster-shell Louse at the hatching period.

LIME-SULPHUR COMPOUND.

(From Bulletin 15, W. S. H. S.)

A preparation of lime and sulphur combined by boiling and first used as a sheep-dip in California, has come to be recognized as an effective remedy for the San Jose scale and other armored scale insects.

Formula.

Fresh (unslaked) lime	15 lbs.
Flowers of Sulphur	15 lbs.
Water	50 gallons

Directions for Preparation. In a kettle of at least forty gallons capacity heat twelve gallons of water. In a separate vessel mix fifteen pounds of sulphur with water enough to make a thin paste. Pour the paste into the heated water and when the mixture is near the boiling point add fifteen pounds of lime. After the lime has completely slaked, boil for one hour, stirring to prevent caking on the sides of the kettle. Then strain into the spray tank (or barrel) and add sufficient water to make fifty gallons of the mixture.

Lime-sulphur wash diluted as above is used only on dormant plants. Where large quantities are used a steam cooking plant is almost a necessity.

Lime-sulphur compound is now offered for sale by different firms. (See page 11.)

There are many advantages in using the commercial lime-sulphur although the cost will be considerably more than that of the home-made article. The commercial product is a clear reddish liquid and is used by diluting with cold water at the rate of one to eight or one to eleven, the latter being the proportion recommended by the manufacturers.

Like the home-made mixture it can be used only as a winter spray.

The lime-sulphur wash probably possesses considerable value as a fungicide also and it has been used to some extent as a summer spray at a dilution of one to twenty-five or one to thirty and the addition of six pounds of fresh lime to each fifty gallons of mixture as a substitute for Bordeaux mixture.

Further trials, however, are needed to demonstrate its value and the strength at which it can be used with safety on growing plants.

NOTICE

The firms named below manufacture spray pumps. There are many others equally reliable whose advertisements appear in farm papers.

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Field Force Pump Co., Elmira, N. Y.
The Goulds Mfg. Co., Seneca Falls, N. Y.
Morrill & Morley Co., Benton Harbor, Mich.

Lime-sulphur compound prepared ready for dilution with cold water may be had from the following firms:

Grasselli Chemical Co., Milwaukee.
The Rex Company, Omaha, Neb.

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State Horticultural Society

BULLETIN NO. 17

The Truth About Fruit Growing in Wisconsin

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Wisconsin State Horticultural Society

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Remit to Secretary W. S. H. S.,
Madison, Wis.

The Truth About Fruit Growing in Wisconsin.

The purpose of this bulletin is to better acquaint the people of Wisconsin with the resources of their own state. Except among the comparatively few who are engaged in raising fruit for market, and finding it extremely profitable, the erroneous notion prevails that conditions in Wisconsin are not well adapted to this business. So widely in fact has this idea prevailed, that any recital of facts concerning even ordinary crops and prices are quite apt to be set down as incredulous.

These ill-founded notions may be ascribed to different causes: First, the somewhat disastrous experience of the early settlers who planted varieties which have since proven to be unsuitable to our conditions. It required about 50 years to learn this lesson of varieties and there are still a few who need to review it occasionally. It may be set down as a fact that we cannot raise successfully such apples as Albermarle Pippin, Baldwin, Rhode Island Greening and others that are standard winter apples in eastern markets; at least we have not yet learned how to raise them. This, however, need cause us no concern except that the failure to produce these kinds was the cause of one of the set-backs to fruit raising in Wisconsin. We can raise better and more profitable kinds as will be shown later.

Secondly: Most of the fruit trees, probably 95 per cent, that are planted each year are planted in small lots in farm orchards; many of these die and it is surprising indeed that any of them live as the average planter cannot or will not understand that a fruit tree requires care or cultivation after planting. If perchance some of these trees survive and bear, the fruit is so badly defaced by insects and disease that it is unsalable.

A third reason and one that exerted a very marked influence in the past was the indifferent not to say discouraging attitude of those directing agricultural education and development in Wisconsin.

The splendid progress made in this state in dairying is due not more to our natural advantages than to the men who pointed out these advantages and enlisted the aid of the State in developing them. No one will doubt that the results have more than justified the effort and expense and every good citizen, even the fruit enthusiasts, should feel proud of Wisconsin's record in dairying and stock raising. That a similar, if not so extensive development might have been possible in fruit raising if similar encouragement had been given, no one doubts. We cite these facts and probabilities to explain the widespread notion that Wisconsin is not a fruit state but directly in connection with this it should be said that the recognition of the possibilities in fruit raising and an effort to develop the business on a commercial scale on the part of all concerned in agricultural uplift at the present time is the most encouraging feature of the present situation.. .

Butter, beef and bacon are very substantial factors both in domestic economy as well as in trade and commerce but strawberry shortcake, cherry pie and apple "sass" are not to be despised.

Dairying and stock raising have been the dominant industries in Wisconsin but fruit raising will soon rank with these in importance if not in extent.

ASSERTIONS.

(1) The conditions of soil and climate are quite as favorable in Wisconsin for the raising of all small fruits, apples and cherries on a commercial or market basis as in Michigan, Indiana, Illinois, Iowa, Missouri, Nebraska or any central western state.

(2) In many respects, as markets, high color of fruit and freedom from frosts, the conditions are more favorable than in any of the states named.

(3) Taking into consideration the capital invested, the raising of apples or cherries in Wisconsin is quite as profitable as in any other state east or west.

(4) Land can be bought in Wisconsin, an orchard planted thereon and brought to profitable bearing age for one-fourth to one-half of the price asked for western irrigated orchard tracts.

While other favorable conditions might be cited these are omitted to give space for the following:

OPINIONS.

At the Annual Convention of this Society held in Madison Jan., 1909, Prof. E. P. Sandsten delivered an excellent address on "The possibilities for Commercial Fruit Growing in Wisconsin." Mr. Sandsten who is now connected with the Bitter Root (Montana) Valley Irrigation Co., was, for seven years professor of horticulture in the University of Wisconsin and by training and experience well qualified to judge of the comparative merits of different sections, having traveled extensively.

The following is quoted from his address:

"In the past I have been somewhat sceptical as to the outlook for commercial fruit growing in Wisconsin. This early impression I gained not only from the discussions in this Society, but from actual observations in the state. A great deal of emphasis, I might even say too much emphasis has been placed upon the all absorbing question of hardiness. In fact, this nightmare has so overshadowed all other factors in fruit growing that many of us have been unable to properly appreciate many of the advantages that Wisconsin really offers along many lines of commercial orcharding.

Why did the early pioneer fruit growers in the state fail, and why are we reminded in and out of season of their failures? A little reflection I think will clear up this subject and forever banish this nightmare of failures which has hung over us so long. First, we should bear in mind that these early fruit growers like all the early pioneers, settled on the prairie or open land where there was no original tree growth. This very fact is a sufficient cause for failure. Trees accustomed to more or less sheltered conditions, or at least to a broken or rolling country will not succeed on the open prairie. Take the mountain ash for example. This tree is a native of Northern Wisconsin and is found wild on the shores of Lake Superior, yet it will not do well, if it lives at all, on the prairie of Southeastern Wisconsin. Hence it should occasion no surprise if many of the Eastern varieties of fruit trees should die under the same conditions. Even our native crab apple is not hardy on the open prairie, nor does the wild plum dug up from the wood and planted on the open prairie prove hardy. Further, even in the most favorable apple growing states there are locations where apples cannot be grown profitably. Why then should Wisconsin be an exception and why should we base the whole future of fruit growing upon the past experience of the pioneer prairie settlers. Their experience and accumulated wisdom, are valuable and good for prairie conditions and for such conditions they have rendered priceless service. * * *

In spite of the wholesale condemnation of eastern varieties, there are localities where many of these so-called "tender" varieties can be grown with success and profit. Our failures have in many cases been due to lack of good management, to proper methods of cultivation, pruning and spraying, together with poor judgment in the selection of varieties of trees and to site and soil. *I am convinced not only from our own experience at the Experiment Station, but from actual observations all over the state, that commercial orcharding can be made as profitable and safe an occupation in Wisconsin as anywhere in the United States. I make this statement with the full knowledge of the marvelous results and profits obtained in other apple-producing states.* These statements are backed by facts and not by fancy. Every year many car loads of summer and fall apples are shipped into Wisconsin, especially into northern Wisconsin from the east and from the west, and sell at prices that are considerably higher than obtained anywhere else. I have a record of one of six car lots of crab apples shipped into Superior and Duluth from Montana, and selling at wholesale for $1.25 and $1.50 a bushel. Think of it! What a gold mine this would be for our own growers! The extra profit received from the difference in rates from Montana to these points would make a large item. Further, large quantiies of Michigan fruit is yearly shipped into the northern half of the state at good profits. Now, no one can deny but what crab apples and summer and fall apples can be grown in Wisconsin, and be grown with success. As for winter apples, we can well afford to let them alone for the present, but even in this, we can be dangerous competitors with other states. When we can grow apples like the Wealthy we can also provide for cold storage so that these can be marketed during the months of December and January, and thus compete with the eastern apples that are shipped into the state. Further, it is recognized among eastern fruit growers that the Wealthy apple is equal and in many cases, superior to the standard winter apples of the east. In fact, the Wealthy is now planted extensively in the east, and is recognized to be the leading fall variety. Further, large quantities are held in cold storage for the winter market, selling at prices equal to the best. One single grower in northern Maryland has 100 acres in Wealthys. If we could confine ourselves to a few standard sorts, and build up a reputation with these sorts, we would make a great advance as a fruit growing state.

After traveling over this state for a number of years, I have become convinced that we have several sections that are admirably adapted for fruit growing. These sections are in many cases not continuous, but are isolated and are the results of topography and geographical location. One would naturally suppose that the best fruit sections would be found along the border of Lake Michigan, and this is true, providing the elevation is sufficient and the character of the soil suitable. There is no question but what apples, plums, and cherries in great varieties can be grown in this section, providing as I have said, that the elevation is sufficient and the character of the soil favorable. Further, there are local conditions in practically every county in the state where large fruits can be grown with profit, possibly excluding those counties and sections of swamps and low sandy lands, and possibly excluding the most northern portions excepting the Bayfield peninsula, but even in these sections a few varieties can be grown. Apart from these there are marked fruit regions, for example the section in and about Baraboo including what is known as the Baraboo Range, and westward into the counties of Richland, Vernon and Crawford. This section is perhaps one of the best fruit regions in the state, and it is only a question of time before commercial orchards will be dotted all over. From my own observations, I am convinced that even the despised Ben Davis apple can be grown successfully in this region. In fact, some of the best specimens of the Ben Davis apples and trees I have ever seen were grown around Baraboo Further, we have to the southwest of Madison a large territory composed of a broken country that has numerous fine sites and locations for commercial orchards. In fact, these lands are better adapted for fruit growing than those farther south, especially in view of the fact that the southeastern counties are more of a prairie nature and trees planted on such lands are subject to winter killing from the effects of the dry winter weather, while those on a higher elevation and in a broken country are not so exposed.

Perhaps we are more interested in pointing out where we fail in commercial fruit growing in Wisconsin, though this subject has been discussed scores of times, still like all good things, needs repeating.

First I would say that our failures, apart from the lack of proper orchard management, selection of soil, have been due to indiscriminate planting of varieties. The truth of this statement can be verified in practically every orchard in the state, large and small. Take almost any of our large growers in the state, and hardly one of them can fill a reasonably large order of one variety of apples This fact prevents the grower from getting into the big markets, and thus he is unable to make it worth while for the buyer to take hold of his crop. No commercial orchard can be a success when it is composed of a score of varieties. To be sure, many of these orchards were planted as an experiment, but is it not time for experimentation to end so far as the grower himself is concerned? I think it is. The Horticultural Society and the Experiment Station can tell very accurately what varieties are adapted to the state, and they can also tell what varieties are the most profitable to grow. Further, the average farmer and fruit grower is no experimenter, nor can he in most cases afford to plant an experimental orchard, as experimental orchards as we all know are not money producers. Further the expense of handling a mixed orchard is considerably greater than one of few sorts, not only in spraying and caring for the orchard, but also in picking and packing.

Another important cause of failure is the universal practice of setting the trees too close together. There are very few orchards in the state where the trees are set sufficiently far apart to permit of easy cultivation, and to provide a normal and full development of the trees. Trees set too closely are not only more difficult to cultivate, but are more subject to the attack of insects and fungus diseases. It is more difficult to spray the orchard, and when the trees are growing close together, they produce too much shade to properly color up and develop the fruit. Further, the fruit grown is small and inferior. There is not enough circulation in the orchard, and fungus diseases thrive under just such conditions. The proper distances to plant apple trees in Wisconsin is from 24 to 30 feet apart. Many growers argue that this is a waste of space, but few of our varieties will stand closer planting if the trees are going to produce a maximum crop of first-class fruit. What we need in Wisconsin today is an application of the fundamental horticultural truths, rather than conducting experiments and discussions of subjects that have only a secondary bearing upon horticulture and horticultural practices. We have accumulated facts and experiments enough to enable any intelligent person to start in commercial fruit growing or fruit growing for home consumption in the state. What we need today is an application of what we really know rather than branching out for other things.'' E. P. SANDSTEN.

The purpose of this publication is to exploit the resources of Wisconsin as a fruit state rather than to discuss the merits or deficiencies of other sections, yet in the view of the tremendous activity of promoters of western irrigated orchard schemes and the very large sums of Wisconsin money being invested in these, the following unsolicited opinion would seem to be pertinent:

''I am familiar with conditions in Virginia, North Carolina, Illinois, Missouri, Michigan, Washington and Williamette Valley, Oregon. I was in Washington and Oregon the past spring and summer, traveled several thousand miles by team and auto, made a *thorough* investigation of numerous propositions, also of ''Business Men's Associations'' and real estate promoters and am sure that any person who investigated *intelligently* should be in a position to dissuade any orchardist in the central, western states from attempting to make even a living from the much advertised ''Ten Acre Tracts,'' or any of the high priced lands. The advertising given those western lands by railroad interests and, recently, by Chicago papers is, in my opinion, an attempt to obtain money by false pretenses and there is no doubt in my mind that the people of limited means investing in Washington or Oregon fruit land at present prices, will in less than five years stand to lose all they have invested.''

F. J. TOLAND.

La Crosse, Jan. 1st, 1910.

Unsolicited letters similar to the above are receivd by the writer almost daily but further consideration of this subject is deferred that attention may be given to—

STATEMENTS CONCERNING WISCONSIN CROPS AND PRICES.

APPLES.

The Orange Judd Farmer estimated the yield of apples in Wisconsin for 1909 at 250,000 barrels. About 200 report blanks were sent out from the office of the secretary of this Society last November for the purpose of testing the accuracy of this estimate as well as to gather other information. From the 59 reports received it seems plain that the estimate was conservative. The reports showed further; that 50,700 barrels of apples were packed and shipped the present season from the 59 points reporting; that fall apples were grown almost exclusively for market; that prices ranged from $2.75 to $4.00 per barrel, net, for No. 1 apples

Crops and Prices.

The following report of yields and prices for three years was submitted by Albert Reis of Ithaca, Richland Co.

''Following I give reports of a few orchards located in Ithaca Township, Richland County, Wisconsin:

No. 1. Report for three years of one and one-quarter (1¼) acres of Wealthys in orchard of Paul Weitzel.

Gross receipts, 1907—95 bbls. @ $4.50	$427.50
‘‘ ‘‘ 1908—20 ‘‘ @ 4.00	80.00
‘‘ ‘‘ 1909—130 ‘‘ @ 4.50	585.00
Average gross income per acre each year,	$291.33

No. 2. Seven acre orchard owned by Roscoe Davis. Age of orchard 12 years, varieties, Lubsk Queen, Wealthy, McMahan, Newell, N. W. Greening.

Gross receipts, 1907—400 bbls. @ $4.50......$1.800.00
" " 1908—100 " @ 4.00...... 400.00
" " 1909—450 " @ 4.50...... 2,025.00
Average gross income per acre each year.........$201.19

N. 3. Ten acre orchard owned by A. J. Weitzel. Varieties, Wealthy, McMahan, Wolf River, N. W. Greening and Newell.

Gross income, 1907—400 bbls. @ $4.50......$1,800.00
" " 1908—425 " @ 4.00...... 1,700.00
" " 1909—500 " @ 4.50...... 2,250.00
Gross income per acre each year..............$191.66

In the Pioneer Fruit Farm orchards owned by John Reis single acres of Duchess apples have brought in one year a gross income of $475.00 while single acres of McMahan, white, have produced in one year as high as $675.00 gross receipts. Single acres of McMahan's white could be given from orchards Nos. 2 and 3 of this report, which would equal these figures."

In the orchard of L. H. Palmer of Baraboo 30 Fameuse trees, 23 years old yielded $220.00 net and 20 McMahan trees, 10 yrs. old $91.00 net for the No. 1 fruit which sold for $3.50 per bbl. net. Mr. Palmer sold 250 bbls. from 100 trees.

Mr. J. H. Palmer of Baraboo sold 1,000 bbls. from 400 trees.

The trial orchard of this Society at Wausau planted in 1897, contains 6⅓ acres of apples of 63 varieties, planted purely for experimental purposes. The 1907 crop exceeded 1,600 bushels, that of 1908 five hundred bushels and the 1909 crop 2,113 bushels, the bulk of which (1909) brought $1.00 a bushel, a considerable portion selling for $1.50 a bushel.

CHERRIES.

The following reports of yields and prices for the season of 1909 were furnished by D. E. Bingham of Sturgeon Bay:

A. L. Hatch,
700 trees, 12 yrs. old, 8 acres, 3,529 cases $4,058.35.
W. I. Lawrence,
600 trees, 12 yrs. old, 3,449 cases, $3,966.35.
D. E. Bingham,
630 trees, av. 7 yrs., 1,800 cases, $2,070.00.

STRAWBERRIES.

Mr. E. A. Richardson, Manager of the Sparta Fruit Growers' Association submits the following on request:

"In regard to the yield of Strawberries, Mr. John P. Peterson, gathered 500 16 qt. cases from an acre the past season which sold for an average of a little over $1.15 per case, ($575.00 per A.). Mr. A. J. Wyman sold 115 cases from ¼ acre which sold for $132.03. There are several others whose acreage yielded as well as the above, but the average yield per acre of all the members of our Assn'n is about 150 cases per acre, ($172.50 per A.). This we consider a very good yield when we take into consideration the varieties of soil which is devoted to the raising of the Strawberry, and the fact that we have been unable to get a full stand of plants for the last 3 or 4 years. However I think that the coming year will see a large increase per acre over the last 3 or 4, as fruiting beds have made a full row and are looking much better than for some time."

COST OF PRODUCTION.

In considering the expense required to bring an orchard to profitable bearing we must consider, briefly at least, certain recognized methods of culture.

Clean culture plan: By this plan the orchard is given clean cultivation until midsummer when a cover crop is planted such as oats, vetch or clover; this crop to be turned under the following spring. Following this system no "catch crops" can be grown and consequently there will be no returns whatever from the land until the trees begin to bear. On the other hand no manure should be required and it is assumed that the growth and vigor of the trees will fully repay the additional cost over the second or:—

Cropping plan: In this case one-half or two-thirds of the land is planted to some crop requiring cultivation as potatoes, beans, etc., leaving a space of 4 to 6 ft. on each side of the tree rows which is cultivated without cropping. The space cropped, if not the entire area, should be manured each season as in the case of other cultivated farm land.

The first method will involve a considerable outlay each year. The cultivation, pruning, seed and planting of cover crops, replacing trees and all other probable expense in connection with a 40 acre apple orchard by this plan has been estimated* at $2,000 for the first six years or $8.33 per acre per year.

This estimate is all on the basis of cash paid for labor at $2.00 a day for man and $4.00 for man and team. In the case of a large fruit farm where no manures are made or available this would seen to be the only rational method of procedure and the few cases where it has been practiced in this state furnish evidence that the results will fully warrant the outlay.

By the second method an orchard can be brought to profitable bearing entirely without expense aside from the cost of the trees and the land may even be a source of revenue as the income from the crops grown between the trees for the first 6 to 8 years will more than pay for all labor on the orchard. This is not guess work but has been repeatedly demonstrated by different growers in this state.

This is a safe, practical and economical method of bringing an orchard to bearing age and is especially adapted to the raising of commercial orchards of 10 to 40 acres where plenty of barnyard manure is available.

COST OF MAINTENANCE.

TREE FRUITS.

Reliable data concerning the cost of maintenance of orchards in Wisconsin is difficult to obtain owing to the fact that there are but few commercial orchards in the state and the further fact that few of these are well cared for.

The expense of maintenance of a cherry orchard at Sturgeon Bay has been estimated at $16.50 per acre per year which includes: Pruning and removal of brush, cultivating 10 times and spraying 5 times. The expense for crates, picking, packing and delivery has been estimated at 75 cents per bushel.

The expense for care of an apple orchard with similar treatment will be about the same; the expense for marketing about 65 cents per barrel for labor and barrel.

The 5 acre trial orchard of the Society at Sturgeon Bay furnishes a concrete sample. In 1909 the expense up to harvesting amounted to $44.50 which included pruning, cultivation and spraying. The crop was picked, packed and delivered on contract for 30c per barrel, the barrels costing 36c each.

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*Average estimates of five of the best informed orchardists in different parts of the state.

SMALL FRUIT.

The Sparta Fruit Growers' Association handles the crop from about 600 acres of small fruits, largely strawberries. Mr. E. A. Richardson writes as follows regarding cost of production:

"Regarding your inquiry as to the cost of production of a case of strawberries: There is a great diffenence in the net returns received by the different growers; this all depends on the number of cases which they receive from one acre. From accounts carefully kept by some growers, and from estimates made by others, I find that the expense for preparing the ground, plants, planting, cultivating, hoeing, mulching and rent of one acre to be approximately $45.00. The greater number of cases that are grown per acre will lessen the initial cost per case as this cost will apply to an acre which will not produce 100 cases, as well as to the acre which will produce 200 cases. To this cost we will have to add about 45c per case for picking, boxing, packing and delivery; this price will not vary much as we pay for picking by the box, and the price of boxing remains about the same whether bought in large or small quantities. Through a series of years the actual cost of the production of an acre of bush berries will not vary greatly from that of the Strawberry, and I think that the net returns will be equally as good.

FRUIT DISTRICTS.

SMALL FRUITS.

Strawberries and bush fruits may be grown successfully in any part of the state. These fruits are now grown more extensively in Monroe county that elsewhere but probably not on account of any particularly favorable factors of soil or climate. It would appear that a few well informed men engaged in the business there many years ago and as the result of close application and intelligent direction, were successful and an extensive development of the business followed as a natural result.

The present very satisfactory condition of the business in the vicinity of Sparta is due to the fact that the growers are well organized for disposing of their crops as the Sparta Fruit

Growers' Association, a purely co-operative company, handles practically the entire crop grown near Sparta.

During the last three or four seasons strawberries have been planted extensively near Bayfield and this promises to be one of the small fruit centers of the state. This region possesses peculiar advantages for the raising of strawberries on account of the late ripening season of the crop, thus affording an excellent market; the firmness of the fruit, the never failing snow blanket for winter protection and freedom from late spring frosts.

These conditions, which also prevail in parts of Douglas, Bayfield, Iron and Vilas Counties and probably farther south afford opportunities for the profitable production of small fruits unsurpassed by any other section of the state.

Other excellent opportunities now exist near hundreds of the larger towns and cities throughout the state where the demand for fresh, home-grown berries always exceeds the supply.

APPLES.

The localities best adapted to the raising of apples on a commercial scale have been outlined in a general way by Prof. Sandsten (p. 7). The district including portions of Sauk, Richland, La Fayette, Grant, Crawford and Vernon counties possess exceptional advantages for commercial apple raising as, character of soil, elevation, nearness to market and present price of land.

The lake-shore counties north of Milwaukee and including all of Door Co. are also recognized as apple counties.

Excellent apple land may be found in Dunn, St. Croix, Pierce and Pepin counties.

The high rolling lands in Monroe, La Crosse, Trempealeau, Eau Claire and Chippewa Counties are also well adapted to apple raising.

Waupaca Co. ranks next to Richland in acreage of commercial orchards and yield of apples.

Some of the finest apples grown in Wisconsin come from Wood Co., near Marshfield.

Much excellent apple land may be found in southern Winnebago Co.

Early apples such as Duchess, Yellow Transparent, McMahan, Patten's Greening & Wealthy ripen perfectly and yield abundantly at Bayfield and on Madeline Island and it is probable that a strip from 3 to 5 miles wide along the south shore of Lake Superior from Superior to Ashland will prove equally well adapted to apple raising when developed.

This Society has demonstrated quite fully that apples can be grown profitably in Marathon Co.

Several promising apple orchards are being developed in Shawano, Langlade and Oconto Counties.

CHERRIES.

The best cherry orchards in Wisconsin are near Sturgeon Bay, and conditions in Door Co. seem to be especially favorable for cherries. It should be said however that the excellent yields noted on page 11 are quite as fully the results of excellent cultural methods as of soil or climate.

Cherries succeed very well in any of the southern counties but it is very doubtful if this fruit can be grown profitably anywhere in central Wisconsin north of Oshkosh with the exception of Door Co. and the possible exception of a limited area near Bayfield.

PLUMS.

So far as present knowledge extends neither the European nor the Japanese plums thrive in Wisconsin and neither should be planted extensively. The one exception to this is the Sturgeon Bay district: there trees of the Japanese varieties are hardy and bear occasional crops.

LAND PRICES.

Land in Wisconsin adapted to fruit raising may be had at any price the buyer chooses to pay between $10.00 and $500.00 per acre. Very good fruit land may be bought in many of the northern counties for $10.00 to $20.00 per acre and expense of clearing will vary from $15.00 to $50.00 per acre while "eighties" with 20 to 30 acres cleared and other improvements sell for $25.00 to $75.00 per acre, depending on character of soil and nearness to market.

Good fruit land, cleared, near Sturgeon Bay commands from $100.00 to $250.00 per acre while unimproved farms in Door Co. may be had from $40.00 to $50.00 per acre.

Farms in the southwestern counties of 160 acres or more with 50 to 100 acres improved vary in price from $30.00 to $50.00 per acre.

It must be clearly understood that these figures are based merely on casual inquiry and refer to no particular pieces of land nor to any particular locality.

Readers seeking more specific information are referred to land companies, real estate dealers or individual owners.

MORE ABOUT APPLES.

Commercial apple orchards in Wisconsin should consist largely of summer and fall varieties.

Experience has shown that varieties like Duchess, Yellow Transparent, Switzer, McMahan, Longfield, Patten Greening, Fameuse and above all Wealthy are the money makers. These kinds ripen in July, August and September just following the strawberry and cherry season and at a time when apples sell more readily than at any other time of the year.

The demand for clean, sound, honestly packed No. 1 Wisconsin grown Duchess has never yet been fully met on the markets of Duluth, Minneapolis and St. Paul, Milwaukee or Chicago. Prices in recent years have ranged from $3.50 to to $5.00 per barrel.

The same is true of the other varieties mentioned especially McMahan and Wealthy. An acre of any of these varieties (trees 10 years or older) should produce 100 barrels annually of such fruit.

With early apples we have a market exclusively our own as these kinds are not extensively grown except as "fillers" in the winter apple sections and the Wisconsin grower may market his entire crop long before Michigan, Illinois, or New York Baldwins, Kings and Greenings are fit to pick and if the production of western Spitzenbergs and Winesaps should reach 100 millions of bushels by 1915 instead of 39 millions as now estimated it could not affect in the least the market for Wisconsin fall apples. This point is worthy of most careful consideration by those who are considering investments in apple orchards.

CONCLUSIONS.

This bulletin was not written for the purpose of convincing any one that opportunities for fruit raising are better in Wisconsin than in any other state because it is very doubtful if this is true.

We do claim, however, that Wisconsin presents exceptional opportunities along certain lines and an attempt has been made to enumerate these without exaggeration.

The figures given herein may appear extravagant to certain farmers in Manitowoc Co. for instance, who the past season brought to market wormy, gnarly apples and received but 25 cents per bushel. The answer to this must be that it was purely a question of quality for at the same time apples of the same varieties found a ready sale in Madison, La Crosse, Eau Claire and other Wisconsin cities at $1.00 to $1.25 per bushel and Wisconsin Duchess and McMahan sold for $4.50 per barrel in Chicago.

Fruit raising is not a short and easy road to unlimited wealth in Wisconsin or elsewhere; strawberries offer the quickest returns, one year, bush fruits next, two to three years, while an apple orchard requires six to eight years before bearing profitable crops. Quite often however all of these may be grown to advantage as well as vegetable crops.

The need now is for young men who will take up fruit growing as a business and not the indiscriminate planting of mixed farm orchards, merely as a side line to general farming.

If the regular farm work receives the attention it deserves the orchard is apt to be neglected and neglect means loss. Every farm should be provided with an orchard sufficient for family needs but aside from this none should be planted. Fruit raising in Wisconsin must be in the hands of specialists as the raising of high class fruit and marketing it to advantage will require about all the brains ordinarily alloted to one person.

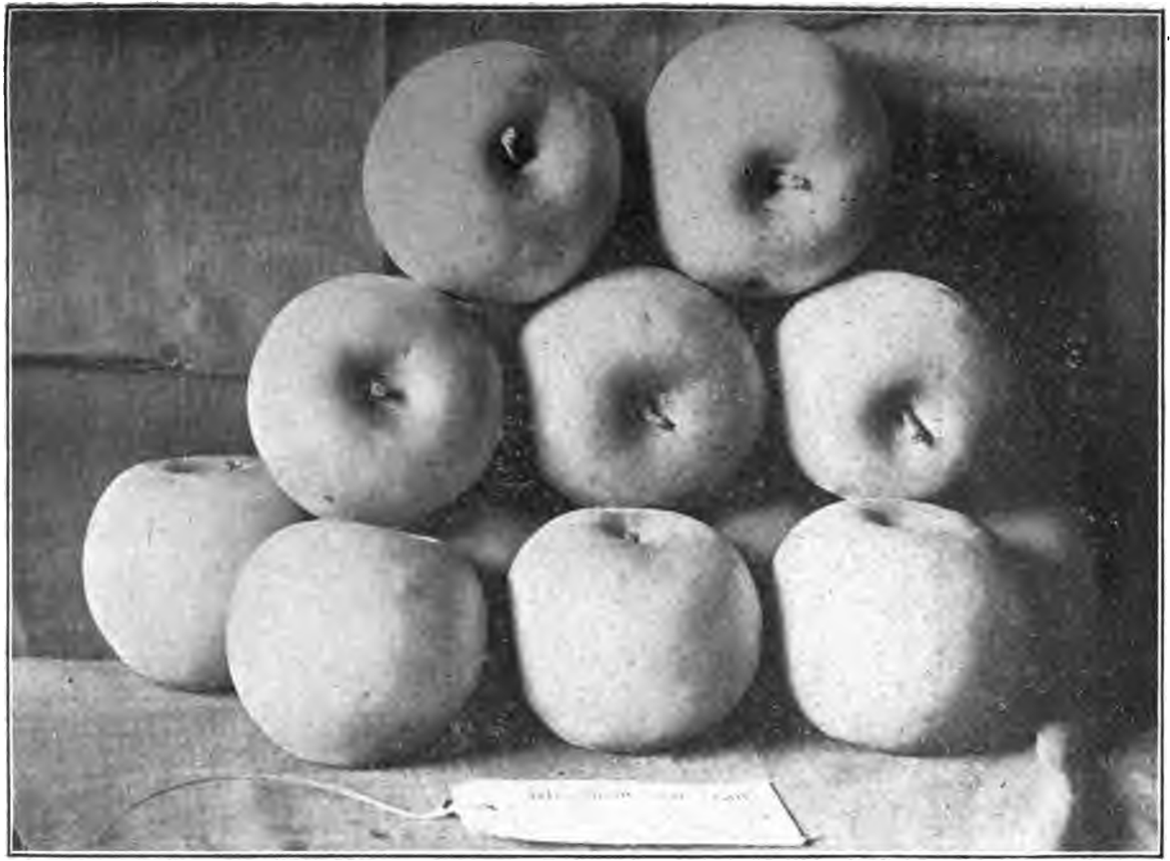
Any person who can acquire 40 to 80 acres of suitable land in Wisconsin accessible to markets can plant one-half of it to fruit and be assured of a good living, in old age a competence and at all times an inspiration afforded by no other line of agriculture.

Fruit growing also provides a season of comparative leisure, the midwinter months.

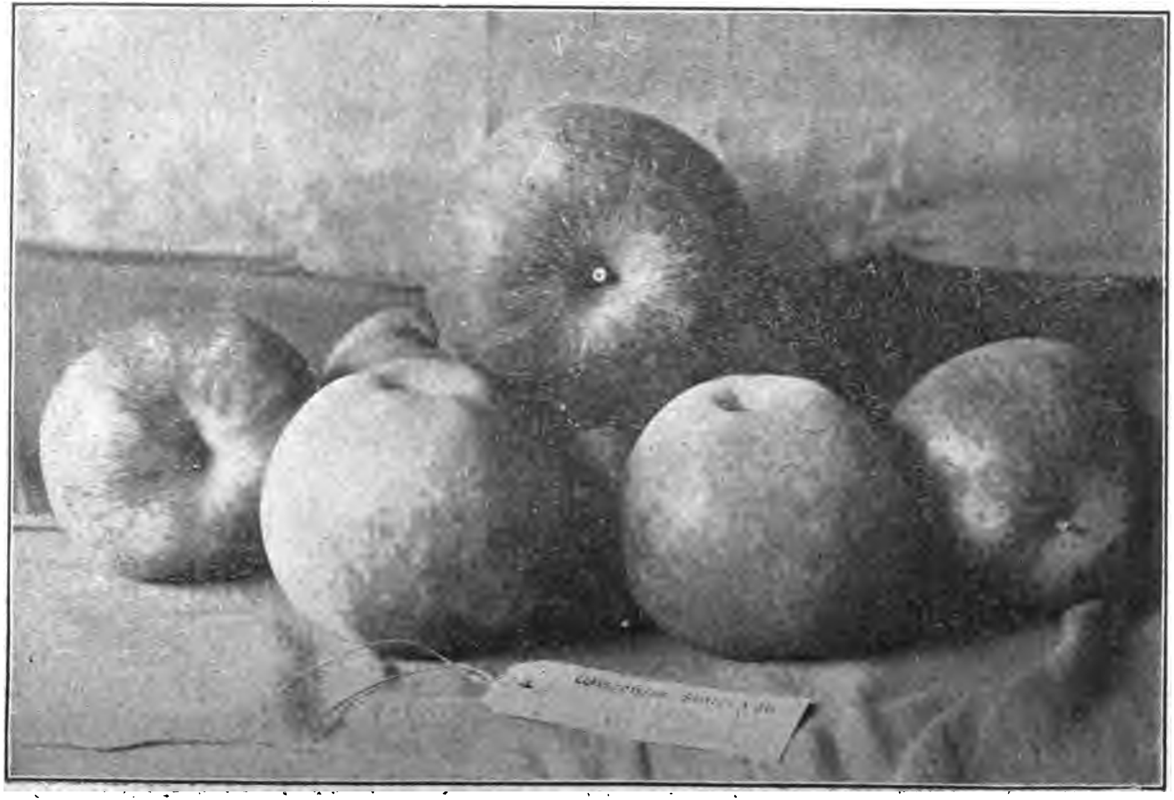
Finally it is here repeated that this publication is intended as a protest against the "one idea" as applied to agriculture in Wisconsin.

FREDERIC CRANEFIELD,
Secretary W. S. H. S.

SOME FRUITS OF WISCONSIN ORIGIN.
Introduced and Named by the State Horticultural Society.



FIRST PRIZE NORTHWESTERN GREENING AT STATE FAIR, 1908.



WOLF RIVER A WISCONSIN PRODUCT.

FIRST PRIZE McMAHAN AT STATE FAIR, 1908.

WISCONSIN

State Horticultural Society

BULLETIN NO. 18

Elementary Facts Concerning Orchard Practice in Wisconsin

MADISON, WIS., MARCH, 1910

☞ The Bulletins and Annual Reports of This Society are sent free to members of the Society

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Annual Membership	$0.50
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Remit to Secretary W. S. H. S.,
Madison, Wis.

Elementary Facts Concerning Orchard Practice in Wisconsin.

Following the publication of Bulletin No. 17, "The Truth About Fruit Growing in Wisconsin," numerous inquiries have been received relative to most favorable soils, number of trees per acre, cultivation, etc., for apples and other orchard fruits.

This bulletin has been prepared for the purpose of answering similar inquiries and is intended only for beginners. Discussions of the more scientific or technical aspects of tillage, pruning, etc., may be found in the annual reports of this society and works on horticulture.

TREE FRUITS.

APPLES.

Where to plant: The most desirable site for an apple orchard is an elevated well drained piece of land having a clay or clay loam soil with limestone foundation.

Soil drainage is of the utmost importance as apple trees cannot withstand wet feet.

Air drainage is also highly important and while a windbreak may occasionally be helpful orchards should not be surrounded by forests or heavy windbreaks or "pocketed" by neighboring hillsides.

A free circulation of air is second only in importance to thorough soil drainage, hence an elevated site.

Slope: Other conditions being equal level land is to be preferred to any slope be it north, east, south, west or cornerwise on account of ease and economy in cultivation and freedom from erosion.

If sloping land only is available choose, 1st the north slope, next the east. A western slope will answer fairly well while the southern exposure is poorest of all. All of this refers to steep hill sides. On gently rolling land but little heed need be given to the contour.

Preparation of soil: The soil should be deeply plowed and leveled. Pulverizing by harrowing or disking is not as necessary as for farm crops except in the case of sod. Trees may be set on spring-plowed sod land if the sod is well worked down with a disk.

Do not plant fruit trees among the stumps and brush of "cut-over" timber lands and expect good results. It has been tried repeatedly in central and northern Wisconsin and always without success. The apple is a product of centuries of culture and demands the environments of civilization. Neither is it wise or economical to plant trees on such land with the exceptation of clearing later,—the fruit trees are in the way.

Preparation of trees: This will take us back to the time the stock is received from the carrier. Small lots,—bundles,—of trees are usually wrapped in burlap and should receive immediate attention, as the packing is not designed to preserve the trees indefinitely but only until the stock reaches its destination. Unpack at once on receipt, spread the roots and cover carefully with moist earth or wet straw, preferably the former. These trees are living things and should be treated as such. Exposing bundles of trees to the sun and wind for 2 or 3 days is not fair either to the trees or the nurserymen. Play fair. If for any reason the planting must be delayed for several days the trees should be "heeled-in" as follows: Dig a trench wide and deep enough to accommodate the roots as shown in Fig. 1. Lay the trees separately in the trench with tops resting on sloping bank. Cover the roots with moist earth sifting it well among the roots. Tramp firmly and when the trench is filled cover again with loose earth. The heeling-in spot should be on well drained ground. Treated in this manner trees may remain for several days or even weeks if in a shaded and cool place. The same applies to bushes and strawberry plants. If trees are shrivelled when received bend down the tops after heeling-in and cover with moist earth. Often after two or three days they will be found to be plump and fresh.

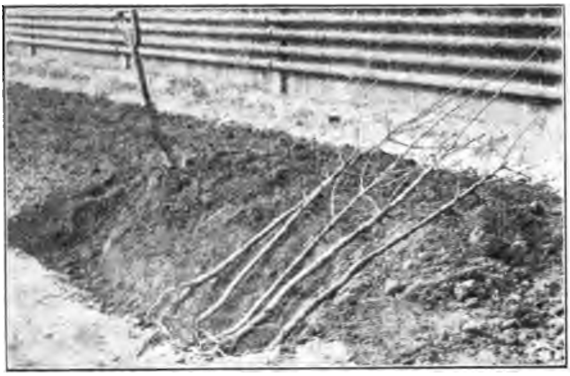

Fig. 1.--Showing method of "heeling-in" trees when planting is delayed.

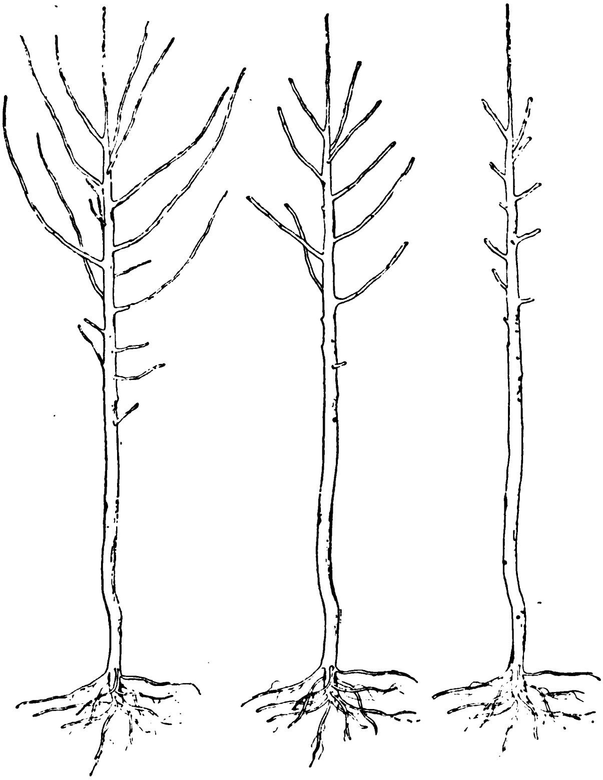

Fig. 2.—Showing methods of cutting back apple trees at planting time. Beginning at left; No. 1, unpruned; No. 2, pruned sufficiently if the tree is well planted in moist ground; No. 3, showing extent of pruning necessary for weakened trees and trees set in dry weather.

Planting: This is a simple operation although often invested with much mystery by the novice. If a tree is sound, roots and tops plump, it is a rather difficult matter to kill it.

Dig holes large enough to accommodate the roots after these have been cut back to sound wood. Fit the holes to the roots, not the roots to the holes. Trim broken and crushed roots back to sound wood. Do not cut off more. The tree was deprived of about seven-tenths of its roots when dug. It will need all that remains. Don't worry about the fine fibrous roots about which so much has been written,—these are dead anyway if the tree has been out of the ground more than an hour,—take care of the larger roots for it is from these that growth starts.

Protect the roots from the sun and wind every moment from the time the bundle is opened until the tree is set. When in the field throw a wet burlap or grain sack over the roots.

The hole should be deep enough to admit setting the tree about two inches deeper than it stood in the nursery. Get down on your knees: It is difficult if not impossible to plant a tree while standing upright. Sift fine earth about the roots and pack firmly, at first with the fingers and when the roots are out of sight get up and tramp firmly with the feet. If the earth is moist and mellow, it cannot be tramped too firmly. It must be in close contact with the roots in order to enable them to take up the water it contains.

When planting on a large scale many devices may be employed to lessen the expense; for instance, a deep dead-furrow may be opened for each line of trees which will save much digging.

Distance apart to set trees: In the case of apples this will depend somewhat on the variety. Such kinds as Wealthy, Tetofsky, Yellow Transparent, Longfield, Malinda and Windsor may be planted closer than McMahan, Duchess, Fameuse, Patten Greening, Wolf River, etc. If the trees are skillfully handled from the beginning as to pruning it is likely that the first named kinds can be grown without loss by crowding, for 20 years at least, if set 20x20 ft. or 108 trees to the acre. Most kinds, however, will require at least 24x24 ft. for best development.

Cherries and plums should be planted 20x20 ft.

Pruning at planting time: The tree is now safely anchored in the ground but the work is not finished. At this point arises a very common cause of failure. Some of the branches must be removed or the tree is apt to perish. Before removal from the nursery the tree had sufficient roots to supply all of its buds with water. In digging, most of the roots have been (necessarily) removed, but the buds are left. When growth begins every healthy bud will push out and call on the roots for water to feed its new-born leaves. The very limited supply that the reduced root system can pump up will be distributed equally and as a result none may have enough to develop its leaves and without leaves the tree must perish. We must, therefore, reduce the number of these water pumps by removing one-fourth to one-half the buds. An illustration of the method of doing it is shown in Fig. 2.

The drier the ground and the weather the more we should cut off. The manner in which the cutting is done will depend to a great extent upon the kind of tree or bush. In apples, plums, etc., we need to bear in mind the ultimate shape of the tree. The framework upon which the branch system is built is determined largely at this time. Remove crowding, crossing and interfering branches. Aim to leave the main branches spirally about the stem rather than opposite. The lower opposite branches in fruit trees form bad forks that may split down later.

PLUMS AND CHERRIES.

These directions apply as well to cherries and plums except that these fruits are less exacting in regard to soil conditions.

ORCHARD PRACTICE.

Treatment after planting: Some systematic and rational method of tillage must be employed in the orchard in order to obtain even a fair degree of success. This is an established fact and facts are remarkably stubborn things.

To plant fruit trees in sod and crop the land either for hay or pasture is to invite failure. Fruit trees are very troublesome in a hay field and should never be set there. Better give the trees to someone who will care for them properly. Half-way methods such as mulching the trees will usually give only half-way results.

A "rational method of tillage" does not necessarily imply clean cultivation of the entire orchard area the entire season but it means that the young trees must be given every opportunity to make a rapid and vigorous growth early in the season. Waugh states the case effectively as follows:

*Treatment after planting:** "The management of the soil in an orchard during the first few years after planting naturally differs more or less from the management given an old bearing orchard. The treatment which the trees receive at this time determines their future usefulness to a very great degree. One of the most important considerations in securing a profitable commercial orchard is to see that the young trees are kept growing just as vigorously as possible and absolutely without interruption from the very first. A tree which is stunted from any cause, which stops growing for a time on any account, might as well be abandoned at once. It is therefore a matter of practical necessity that an orchard should receive thorough cultivation during the years of its beginning according to some well-matured and judicious plan."

There are at least two recognized methods, either of which will produce good, profitable trees at the end of ten or twelve years. One may be called the "Catch crop" plan and consists in planting two-thirds to three-fourths of the space between the tree rows to some crop requiring cultivation as corn, potatoes, beans, etc., leaving a space 4 to 6 ft. on each side of the tree rows which is cultivated without cropping. Following this plan the orchard should be manured each season as in the case of other cultivated farm land. By this method an orchard can be brought to profitable bearing entirely without expense aside from the cost of the trees and the land may even be a source of revenue as the income from the crops grown between the trees for the first six to eight years will more than pay for all labor on the orchard. This is not guess work but has been repeatedly demonstrated by different growers in this state.

This is a safe, practical and economical method of bringing an orchard to bearing age and is especially adapted to the raising of commercial orchards of 10 to 40 acres where plenty of barnyard manure is available.

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* The American Apple Orchard, Waugh, Orange Judd Co., New York.

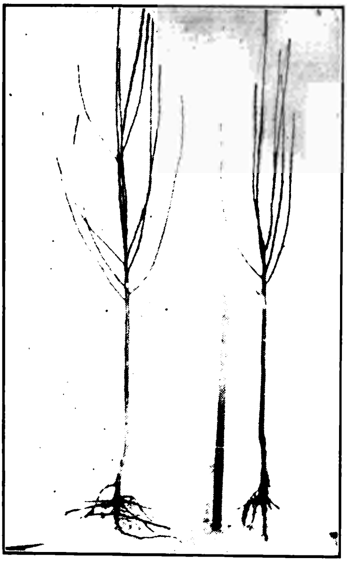

Fig. 3.—Good specimens of "three year old" apple trees as received from nursery.

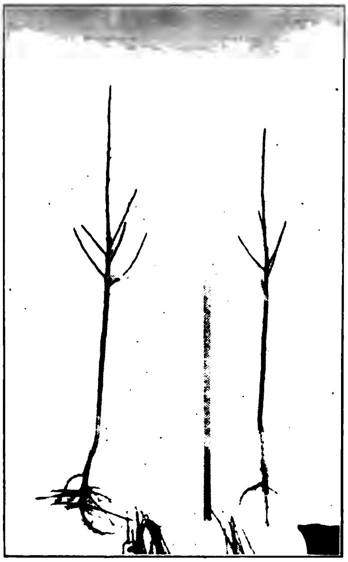

Fig. 4.—Trees shown in Fig. 3 cut back for planting. The "leaders" too long in both cases.

The second method involves clean cultivation until midsummer when a cover crop is planted such as oats, vetch or clover; this crop to be turned under the following spring. Following this system no "catch crop" can be grown and consequently there will be no returns whatever from the land until the trees begin to bear. On the other hand no manure should be required and it is assumed that the growth and vigor of the trees will fully repay the additional cost.

The second method will involve a considerable outlay each year. The cultivation, pruning, seed and planting of cover crops, replacing trees and all other probable expense in connection with a 40 acre apple orchard by this plan has been estimated at $2.000 for the first six years or $8.33 per acre, per year.

This estimate is all on the basis of cash paid for labor at $2.00 a day for man and $4.00 for man and team. In the case of a large fruit farm where no manures are made or available this would seem to be the only rational method of procedure and the few cases where it has been practiced in this state furnish evidence that the results will fully warrant the outlay.

*Cultivation of bearing orchards:** "When the trees have attained approximately their full dimensions the problem is changed somewhat. No catch crops can be grown between the trees, and perhaps even the temporary trees, or fillers, in double-planted orchards have to be removed. Possibly the trees shade the ground so completely that no weeds can grow, although that will hardly be the case in any well-managed plantation. Under such circumstances the fruit grower is apt to feel that cultivation is hardly necessary any longer.

"When we consider the fundamental objects of tillage, however, it will be seen that the requirements of the full-grown, mature, bearing orchard are the same as those of the young orchard. Plant food is still being used in quantities as great as ever, perhaps greater; and to unlock the stores of plant food in the soil requires continual cultivation. The physical condition of the soil is as important now as it ever was, and a good physical texture is preserved chiefly by the stirring of the soil in cultivation. No, it is a great mistake to suppose that when an orchard is fully grown it no longer needs the cultivator, or that it needs cultivation less than formerly. The work must still go on."

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* Waugh, *Ibid.*

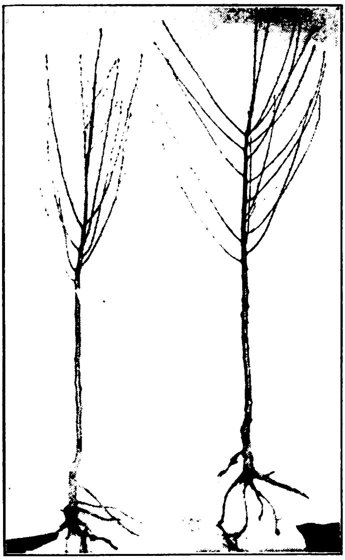

Fig. 5.—Good cherry trees.

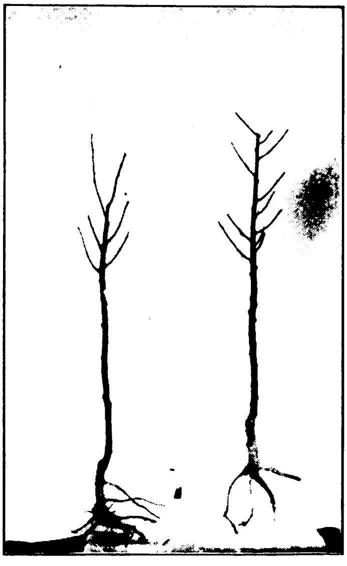

Fig. 6.—Same cut back for planting.

The writer is well aware that there are in this state several fruit growers who do not accept these opinions and call attention to sod orchards which have apparently been a source of profit. It is likely that these orchards have yielded good returns not on account of the system followed but rather in spite of it.

The few orchards in Wisconsin in which an intensive system of tillage has been practiced have yielded the highest returns.

The following hints, adopted from Bull. No. 1 of this society, regarding soil, site, etc., for the common fruits, may prove helpful to the amateur:

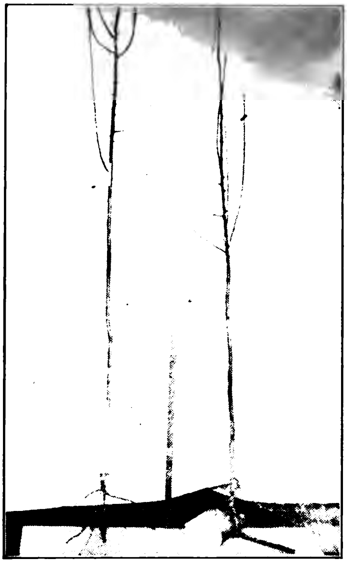

Fig. 7.—Very poor trees, especially one on left. Such trees are nearly worthless.

APPLES.

Soil: Clayey loam with permeable clay subsoil.

Site: Elevated—north slope preferable to south slope.

Distance apart to set trees: 20 to 24 feet.

Age of Trees to Set: Three year old trees preferable.

Protection: Spray with Bordeaux mixture and lead arsenate as the buds appear and after blossoms have fallen and again when the fruit is set. Protect trunks with wrappers. Keep ground clean; rubbish harbors borers.

Pruning: In March cut out interfering branches—keep center of tree open. Head tree low when planting—24 to 30 inches.

PLUMS.

Soil: Any well drained land. Native plums are adapted to a wider range of soil than other tree fruits. Many varieties thrive on sandy soil.

Site: Not as exacting as apples.

Distance: 18 to 20 feet.

Age of Trees: 2 to 3 years.

Culture: Same as for apples.

Protection: Same as for apples. In addition jar for curculio and gouger.

Pruning: Cut back annually, in spring, the strongest shoots. Plums require close pruning.

CHERRIES.

Soil: Light, well drained soil. Cherries will not thrive on heavy moist land.

Distance: 20 feet.

Age of Trees: 2 years old.

Culture: Same as for plums.

BLACKBERRIES AND RASPBERRIES.

Soil: Light loam with clay subsoil. The bramble fruits thrive best when the roots may penetrate a cool subsoil.

Site: Level ground.

Distance 4 by 8 feet.

Culture: Shallow cultivation throughout the season. After first year provide post and wire trellis about two feet in height. Some low growing varieties do not require support. Most varieties require winter protection. Bend the plants to the ground and cover with two to four inches of earth.

Pruning: Remove and burn all the fruiting canes as soon as crop is picked. Leave but four to six new shoots for succeeding crop.

GRAPES.

Soil: Any well drained soil. Thrive somewhat better on light loam or sandy soil.

Site: South slope preferred, to afford air drainage and sunlight.

Distance: 8x8 feet.

Age of Plants: 1 year.

Culture: Clean culture; provide six-foot post and wire trellis for support of vines after the first year. Prune vines in October and protect by covering with earth.

Protection: Spray with Bordeaux once before leaves appear and again when leaves are fully expanded.

Theory of Pruning: "Fruit is borne on wood of the present season, which arises from wood of the previous season." Renew bearing canes every three or four years.

STRAWBERRIES.

Soil: Any well enriched and well drained land. (Good corn land.)

Site: Immaterial.

Distance: 2 by 4 feet.

Plants: Only new runner plants (current season's growth) should be used.

Culture: Plant in spring; use only rotted manure for enriching land. Fall plowing preferable. Keep plantation free from weeds and grass. Confine plants to rows not more than 18 inches wide by cutting off runners. Cover plants lightly with marsh hay in November for winter protection. Do not fruit a plantation more than two years. To keep the rust in check spray with Bordeaux mixture once before the blossoms open and again after the fruit is set.

CURRANTS AND GOOSEBERRIES.

Soil: Well enriched, moist land.

Site: Immaterial.

Distance: 4x4 feet.

Age of Plants: 2 years.

Culture: Cultivate thoroughly throughout the season. A heavy mulch of coal ashes may be applied about the roots to advantage.

Protection: Spray with Bordeaux in June to prevent fungus which causes premature dropping of leaves. Spray frequently with white hellebore (1 oz. to 3 gal. of water) as worms appear.

Pruning: Remove one-quarter to one-third of oldest canes each year.

WISCONSIN

State Horticultural Society

BULLETIN NO. 19

SPRAYING

MADISON, WIS., APRIL, 1910

☞ The Bulletins and Annual Reports of This Society are sent free to members of the Society

THIS BULLETIN CONTAINS THE FORMULA FOR

BORDEAUX MIXTURE

AND DIRECTIONS FOR ITS PREPARATION

PLEASE PRESERVE FOR FUTURE REFERENCE.

Wisconsin State Horticultural Society

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Remit to Secretary of Wisconsin State Horticultural Society,
Madison, Wis.

INTRODUCTION.

Wormy and diseased fruit is worthless; sound fruit is always saleable. Spraying gives sound fruit.

Farmers and others who have but few fruit trees as well as professional growers now realize that spraying is something more than a theory,—that it pays to spray.

This is evident from the constantly increasing number of applications for our bulletins on spraying, and the letters of inquiry on this subject.

This increased interest in spraying is one of the most encouraging features in connection with educational work in horticulture.

One year ago this society issued Bulletin No. 15 on spraying. An edition of ten thousand copies was printed all of which have been distributed. This bulletin is in part a reprint of No. 15 to which has been added a part of Bulletin No. 16 "The Oyster Shell Bark Louse."

As stated in Bulletin No. 15 the purpose is to provide in concise and convenient form, the formulas and directions for preparing the standard spraying mixtures.

These formulas and accompanying suggestions have been compiled from different sources, largely Experiment Station literature. It is intended to give full credit in every case.

FREDERIC CRANEFIELD,
Editor.

READY REFERENCE.

FOR THE CURRANT WORM: Poison the foliage with white hellebore. Arsenate of lead may be safely used when fruit is immature.

FOR CODLING MOTH (causing wormy apples): Spray with Arsenate of lead combined withith Bordeaux mixture as soon as the blossoms fall and again 10 days later. For Second brood spray in August.

FOR APPLE SCAB: Spray with Bordeaux mixture, combined with arsenate of lead as above.

FOR SHOT HOLE FUNGUS AND MILDEW ON CHERRY AND PLUM: Bordeaux early and late.

For "damping" of plants in seed-bed or hot-bed use "Liver of Sulphur."

NOTICE. When "lime" is mentioned in this bulletin, fresh, unslaked or quick lime is meant. Never use slaked lime in the preparation of spraying mixtures.

SEE SPRAY CALENDAR, p. 24.

NOTICE.

The following lists are given for the convenience of our readers and have been compiled from advertisements in horticultural journals. Nothing given herewith should be construed as a recommendation of any firm or machine.

SPRAY PUMPS.

The Deming Co., Salem, Ohio.
R. H. De Voe & Co., Binghampton, N. Y.
The E. C. Brown Co., Rochester, N. Y.
Friend Mfg. Co., Gasport, N. Y.
Spraymotor Co., Buffalo, N. Y.
Wallace Machinery Co., Minneapolis, Minn.
Field Force Pump Co., Elmira, N. Y.
The Goulds Mfg. Co., Seneca Falls, N. Y.
Morrill & Morley Co., Benton Harbor, Mich.
F. E. Meyers & Bro., Ashland, Ohio.
The New Way Motor Co., Lansing, Mich.

THE FOLLOWING FIRMS SELL ARSENATE OF LEAD.

Grasselli Chemical Co., Milwaukee.
Sherwin Williams Co., Pullman Sta., Chicago, Ill.
Merrimac Chemical Co., Boston, Mass.
Vreeland Chemical Co., Little Falls, N. J.

LIME-SULPHUR COMPOUND PREPARED READY FOR DILUTION WITH COLD WATER MAY BE HAD FROM THE FOLLOWING FIRMS:

Graselli Chemical Co., Milwaukee.
The Rex Company, Omaha, Neb.

FORMULAS.

INSECTICIDES.

"Any substance which is used to destroy or repel insects may be termed an insecticide; and any substance which destroys fungi, or which prevents their injurious growth on vegetation, a fungicide. No substance, so far as known, will answer both purposes equally well."—Lodeman.

No extended list of formulas will be given in the following pages. In fact, out of the long list of remedies published from time to time but three insecticides and one fungicide are now recognized as standard remedies, viz., an arsenical poison for biting insects, kerosene emulsion and lime sulphur for sucking insects and some form of copper for fungi.

INSECTICIDES.

(For biting insects.)

PARIS GREEN.

Paris green	1 to 2 lbs.
Fresh (unslaked) lime	1 lb.
Water	200 gallons

Paris green is heavier than water and the mixture must be kept in constant motion during spraying operations to prevent settling.

It is often adulterated.

*"The purity of a sample of Paris green can not be known with certainty without the making of a chemical analysis. There are, however, a few simple tests by which its quality may be fairly well determined by the orchardist.

The color should be a beautiful clear green. Adulterations sometimes give it a faded or dull appearance.

A good quality of Paris green dissolves completely in Ammonia water."

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* Bull. 120 Ill. Exp. Sta.

Gypsum and slaked lime are two adulterants commonly used.

Paris green if used on growing plants greatly in excess of the above formula may injure the foliage. The addition of the lime overcomes the caustic properties and renders it safe under all conditions.

Dry Paris green may be used pure if applied in small quantities. Different "Dry powder guns" have been invented for this purpose.

While Paris green, if pure, is a valuable insecticide, it is being rapidly displaced in orchard spraying by arsenate of lead.

ARSENATE OF LEAD.

(A poison for biting insects.)

Formula.

Arsenate of lead	2 to 3 lbs.
Water	50 gallons

Arsenate of lead is a combination of arsenate of soda and sugar of lead. Several firms now offer this valuable insecticide prepared ready for use.

Arsenate of lead may be used in any reasonable quantity without danger of injury to foliage.

It remains in suspension longer than Paris green.

It adheres better to foliage; has remained on foliage from June to September in sufficient strength to kill web-worms.*

It may be used for any purpose for which Paris green is employed in liquid sprays. Arsenate of lead has been used in spraying the Wausau orchard the past five seasons with perfect satisfaction and is being used and highly recommended by several Wisconsin fruit growers.

When a large quantity of arsenate of lead is needed the cost may probably be reduced by using a home-made compound. The difficulty lies in the possibility of securing materials of high grade. For those who wish to attempt it the following from Bull. 120, Ill. Agr. Exp. Sta. will be helpful.

"Arsenate of lead is prepared for spraying in the following manner: Use

10 ounces arsenate of soda,
25 ounces acetate of lead,
50 gallons of water.

Dissolve the 10 ounces arsenate of soda in 1 gallon of water and 25 ounces acetate of lead in 2 gallons of water. Pour the two solutions, one after the other, into a mixing tank, or directly into the spray tank, containing 47 gallons of water. Stir thoroughly to insure a perfect combination of the two chemicals. The white precipitate which forms when the two solutions combine in the water is a mixture of arsenate of lead and other compounds formed when the two chemicals unite."

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* Bull. 213 N. J. Agr. Exp. Sta.

A remedy for the potato beetle, codling moth and other biting insects. Commonly used with Bordeaux mixture.

WHITE HELLEBORE.

(For biting insects.)

Powdered white hellebore is commonly employed to destroy currant and cabbage worms and on fruits and vegetables where more poisonous substances cannot be used with safety.

Formula.

White hellebore	1 oz.
Water	2 to 3 gallons

It may also be used dry either alone or mixed with flour, land plaster, soot, etc.

White hellebore is scarcely poisonous to the higher animals and may be used freely on fruits and vegetables when these are at any stage of maturity.

ARSENITE OF LIME.

This is a combination of white arsenic and lime. If properly prepared it may be safely used, especially when combined with Bordeaux mixture, and costs considerably less than either Paris green or arsenate of lead.

It must be kept in mind that free or water soluble arsenious acid, white arsenic, is very destructive to growing plants and in making arsenite of lime sufficient lime should be used to effect a perfect combination.

The following formula and directions are taken from Bulletin 213, N. J. Exp. Sta.

Formula.

White arsenic	1 lb.
Fresh lime	2 lbs.

*"Slake the lime and arsenic together with just water enough to form a smooth paste, stirring while the process is going on so

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* Bull. 213 N. J. Agr. Exp. Sta.

as to form a perfect mixture. This mixture may be used at the rate of one pound of the arsenic to 300 gallons of water, or Bordeaux mixture.

"By boiling 1 pound of white arsenic and 2 pounds of lime in 2 gallons of water forty minutes, a more perfect combination of the materials is obtained, which may be used at the same rate as above."

ARSENITE OF SODA.

White arsenic	1 lb.
Sal soda	4 lbs.
Rain water	1 gallon

Boil the arsenic and soda in the soft water for from 15 to 30 minutes, until the arsenic dissolves. To prepare for use slake 2 pounds of lime in 2 gallons of water and add one pint of the arsenite of soda. When thoroughly mixed add water or Bordeaux mixture to make 40 gallons. Never use the arsenite of soda without lime.

If combined with Bordeaux an excess of lime should be used in preparing the Bordeaux.

While these home-made preparations are effective and cheaper than the commercially prepared poisons great care is needed in preparation and an error might easily cost more in burned foliage and loss of crop than the extra cost involved in the use of either Paris green or commercial arsenate of lead. The latter is recommended for spraying fruit trees.

KEROSENE EMULSION.

(For sucking insects.)

Used only to destroy sucking insects. It must be applied to the insects and cannot be used as a preventive.

This is the standard remedy for sucking insects, such as, apple aphis, plum aphis, oyster shell bark louse, etc.

Formula.

Dissolve 1 lb. hard soap in 2 gallons of boiling water.

While hot add 2 quarts kerosene.

Churn or shake the mixture while hot for 5 to 10 minutes or until it assumes a creamy consistency.

Add 6 gallons of water before using.

Another plan consists in using sour milk instead of the soap water, the object in either case being to hold the kerosene in suspension while it is applied to the insects.

The most approved method of applying kerosene is by means of a special pump designed to mix kerosene and water. These pumps are made by different firms in various sizes from a hand pump or syringe which may be had for 75 cents, to a barrel pump costing $20.00. This is the cheapest, most agreeable and by all means the best method of applying kerosene.

LIME-SULPHUR COMPOUND.

A preparation of lime and sulphur combined by boiling. An effective remedy for the San Jose scale, Oyster Shell Bark Louse and other armored scale insects.

Formula.

Fresh (unslaked) lime	15 lbs.
Flowers of sulphur	15 lbs.
Water	50 gallons

Directions for preparation:*—"In a kettle of at least 40 gallons capacity heat 12 gallons of water. In a separate vessel mix 15 pounds of sulphur with water enough to make a thin paste. Pour the paste into the heated water and when the mixture is near the boiling point add 15 pounds of lime. After the lime has completely slaked, boil for one hour, stirring to prevent caking on the sides of the kettle. Then strain into the spray tank (or barrel) and add sufficient water to make 50 gallons of the mixture."

Lime-sulphur wash diluted as above is used only on dormant plants. Where large quantities are used a steam cooking plant is almost a necessity.

Lime-sulphur compound is now offered for sale by different firms.

There are many advantages in using the commercial lime sulphur although the cost will be considerably more than that of the home-made article. The commercial product is a clear reddish liquid and is used by diluting with cold water at the rate of one to eight or one to eleven, the latter being the proportion recommended by the manufacturers.

Like the home-made mixture it can be used only as a winter spray.

The lime-sulphur wash probably possesses considerable value as a fungicide also and it has been used to some extent as a summer spray at a dilution of one to twenty-five or one to thirty and the addition of 6 pounds of fresh lime to each 50 gallons of mixture as a substitute for Bordeaux mixture.

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* Bull. 120 Ill. Agr. Exp. Sta.

Further trials, however, are needed to demonstrate its value and the strength at which it can be used with safety.

BORDEAUX MIXTURE.

The control of fungous diseases is accomplished by the use of some form of copper salts, usually copper sulfate, known also as blue-stone, blue vitrol, etc.

Copper sulfate may be used on dormant plants when dissolved in water at the rate of 2 pounds to 50 gallons of water, but *this solution must not be used on growing plants.*

Copper sulphate in combination with fresh lime forms the standard and well known fungicide Bordeaux mixture.

Various formulas are quoted, but the following is now accepted as safe and reliable:

Copper sulfate	4 lbs.
Fresh lime	5 lbs.
Water	50 gallons

In general terms, the copper sulfate should be dissolved in one-half of the water, the lime slaked in the remainder and the two solutions poured together. This results in a chemical action giving rise to a new substance preserving the fungicidal properties of the copper sulfate and if properly made will not injure foliage.

Bordeaux mixture is used as a *preventive* of apple scab, asparagus rust, mildew on grapes, roses and other plants, potato blight and rot, shot-hole fungus on plum and cherry and other fungous diseases.

Helpful Hints in Making Bordeaux Mixture.

(1) Have on hand three barrels and two pails (wood or fiber).

(2) Twenty-five gallons of water in each of two of the barrels.

(3) Dissolve 4 pounds of copper sulfate in one barrel by suspending in a coarse burlap as near the surface of the water as possible; in this way it will dissolve in a few minutes, while if allowed to settle to the bottom it would require several hours to dissolve.

(4) Place the lime in a pail and slake by adding water slowly until a paste is formed. (The lime for Bordeaux mixture should be slaked exactly as for building purposes.)

(5) Pour this lime paste into the second barrel and stir thoroughly.

(6) Add the required amount of arsenate of lead to the lime water.

(7) Now pour into the third (empty) barrel first a pailful of the copper sulfate solution, then a pailful of the lime water, or better, let two persons work at the job, pouring together.

(8) The resultant mixture should be of an intense blue color. If any tinge of green appears it is not good Bordeaux mixture.

(9) The lime-water should be strained to remove the coarse particles which serve to clog the nozzles in spraying.

(10) Sufficient lime must be used to combine with all of the sulfate or harm will result. The formula given above provides an excess, but such excess is preferable to a slight deficiency. Use all of the lime water.

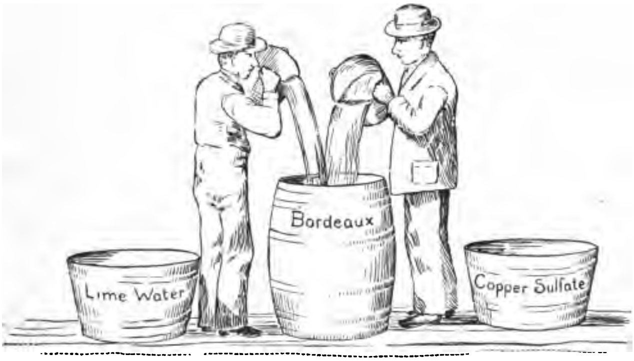

Fig. 1. Illustrating method of making Bordeaux mixture. Adapted from Farmers' Bulletin No. 38, U. S. Dept. of Agr. B. T. Galloway, author.

(11) Test the mixture. It is always advisable to test every barrel of the mixture before using to detect the presence of any free or uncombined copper which might injure foliage.

Test No. I.

Dip a bright, clean, steel knife blade into the prepared Bordeaux mixture; if any, even the slightest, deposit of copper appears on the blade after a few moments' exposure to the air it is an indication that more lime is needed.

The knife blade should be thoroughly whetted before using for a second test. While this is simple and fairly reliable,

Test No. II,

or the ferro-cyanide of potassium test is more accurate.

Ferro-cyanide of potassium may be purchased at any drug store.

Place a small quantity (1 oz.) in a bottle and add water slowly until nearly all of the yellow crystals are dissolved. Stir the Bordeaux thoroughly and dip out a few ounces in a saucer. Add a few drops of the ferro-cyanide solution; if any brown discoloration appears it is an indication that more lime is needed. This is a delicate and reliable test.

The ferro-cyanide is a violent poison and should be labeled as such.

Three Things to Avoid in Making Bordeaux Mixture.

(1) Do not use iron or steel vessels for the sulfate or Bordeaux. Not only will these be corroded but the chemical action resulting from continued contact may injuriously affect the mixture. Tinned or galvanized pails are unsafe, as the zinc or tin coating is apt to be imperfect. Use only wood, copper, earthenware or glass.

(2) Do not dissolve the sulfate and lime each in 2 to 4 gallons of water as formerly recommended and then mix the concentrated solutions; curdling will result and after dilution difficulty will be experienced in keeping the Bordeaux in suspension.

(3) Do not fail to stir the ingredients while mixing and the resultant mixture when spraying. If allowed to settle the only portion possessing fungicidal value quickly settles.

Keeping Qualities of Bordeaux Mixture.

Reports are on record of the use of Bordeaux mixture several days after mixing with no injurious results, but it is generally agreed that for perfect safety it should be used only when fresh. The expense of a barrel of the mixture is too slight and the chances of injury too great to warrant using Bordeaux that has been made more than 24 hours.

The use of Stock Solutions in Preparing Bordeaux Mixture.

If more than one barrel of Bardeaux is required much time may be saved by using stock solutions.

Dissolve 100 pounds, for example, of copper sulfate in 50 gallons of water by suspending in a coarse sack as advised above; slake 100 pounds of lime in another vessel and dilute to 50 gallons; two gallons from the sulfate solution and two and one-half gallons from the lime solution will then contain the requisite amount of ingredients for one barrel of Bordeaux.

Such a stock solution may be kept indefinitely if covered, otherwise the evaporation of water from the sulfate solution would result in a more concentrated mixture and the lime would deteriorate. The lime may be covered with water.

The Bordeaux should be tested when made from stock solutions as when made direct.

This method of using stock solutions is now employed in all extensive spraying operations. In cases where large quantities of spray material is used elevated tanks should be employed from which the solution may be drawn directly into the spray barrel or tank.

Potassium Sulphide.

(Liver of Sulfur.)

For checking the spread of certain surface feeding fungi, as gooseberry mildew, grape mildew, rose mildew and many of the fungi which cause "damping" of young plants in the seed bed, potassium sulphide may be used to excellent advantage.

Formula.

Potassium sulphide	4 ounces
Water	10 gallons

The solution must be used as soon as made, as it quickly loses its strength.

Any unused portion of the potassium sulphide should be kept in a tightly corked bottle to prevent loss of strength.

Combining Insecticides and Fungicides.

Either arsenate of lead or Paris green may be safely combined with Bordeaux mixture. In fact, in orchard spraying operations it has come to be a common practice to add either Paris green or arsenate of lead to Bordeaux at every application. By this means biting insects and fungi are controlled at a single operation. No other fact is more important than this in spraying.

When using arsenate of lead with Bordeaux always add the arsenate to the lime water, instead of pouring it into the combined copper sulfate and lime; this is important.

Other combinations than the above have been attempted, but with only slight success, as combining kerosene emulsion and Bordeaux; kerosene emulsion and Paris green, etc.

THE OYSTER SHELL BARK LOUSE.*

We are sometimes told that the numerous insects and diseases which seem to the superficial observer to be created for the sole purpose of harassing the fruit-grower and destroying his crops are really, like weeds, blessings in disguise.

Without attempting to pursue this line of thought to a conclusion it may be said that the San Jose scale and the Oyster-shell Bark Louse seem to be examples of so-called enemies which might serve to prove such an assumption.

The Oyster-shell Bark Louse has been gaining headway steadily in Wisconsin orchards for over fifty years but has passed unnoticed in most cases until the advent of the San Jose scale and the consequent agitation respecting it.

Following several years of warning through bulletins and the press, owners of fruit trees have quite generally come to recognize the dangers from infestation by the San Jose scale, are looking for it, and in so doing dicover the less dangerous but not to be despised Oyster-shell Bark Louse.

So numerous are the inquiries received at this office concerning this insect that the following concerning its life history and methods of control has been prepared as a convenient means of answering them.

The Oyster-shell Bark Louse is not a newly discovered insect it having been described in a paper prepared for the Massachusetts Agricultural Society in 1794 and was no doubt well established in the New England colonies at that time.

According to Fitch it was introduced into Wisconsin at Kenosha in 1840.

Life History and Appearance.

"It appears in the form of minute scales, about one-sixth of an inch long, of a brownish or grayish color, closely resembling that of the bark of the tree, and somewhat like the shell of an oyster in shape, adhering to the surface of the bark, and placed irregularly, most of them lengthwise of the limb or twig, with the smaller end upwards. In some instances the branches of apple-trees may be found literally covered and crowded with these scales; and where thus so prevalent they seriously impair the health and vigor of the tree, and sometimes cause its death.

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*Reprint in part of Bull. No. 16 W. S. H. S.

Under each of these scales will be found a mass of eggs varying in number from fifteen or twenty to one hundred or more; these during the winter or early spring will be found to be white in color, but before hatching they change to a yellowish hue, soon after which the young insects appear. This usually occurs late in May or early in June, and, if the weather is cool, the young lice will remain several days under the scales before dispersing over the tree. As it becomes warmer, they leave their shelter, and may be seen running all over the twigs looking for suitable locations to which to attach themselves. A large proportion of them soon become fixed around the base of the side-shoots of the terminal twigs, where, inserting their tiny sharp beaks, they subsist upon the sap of the tree. Only one brood is produced annually in the North, the eggs remaining unchanged under the scale for about nine months.

"As the Oyster-shell Bark Louse retains power of motion only for a few days at most after hatching, it is mainly disseminated to distant places by the distribution of young trees from infested nurseries. In the orchard and its immediate neighborhood it may be spread by being carried on the feet of birds, or attached to the larger insects, or may be aided by the wind in passing from tree to tree, while it is itself so brisk in its active state that it can travel two or three inches in a minute, and hence might in this way reach a point two or three rods distant before it would perish. Although this insect essentially belongs to the apple-tree, it is frequently found on the pear, and sometimes on the plum and the currant bush."—Insects Injurious to Fruits. Saunders.

As will be seen later the time when the eggs hatch is an important factor in the control of this pest and the following will therefore be helpful:

"Dr. Mygatt in Illinois in 1854 laid down the rule that the hatching of the eggs began just following the time of the dropping of the petals from the apple blossoms. A rule of this kind is more reliable than the fixing of an arbitrary hatching date which is subject to deviation due to climatic conditions of the spring. Just before hatching the eggs turn to a pale-yellow color. The young lice upon hatching, crawl outward upon the twigs or settle upon fresh areas on the trunk and soon begin to secrete a white downy covering over themselves which after a few weeks becomes hardened and begins to assume the form and texture of the older scale. The males as adults are minute winged insects which are scarcely ever seen.

"Young twigs are more generally infested than older ones though this is not without exception, as for instance when whole trees become encrusted and killed. The forks of twigs or the points separating the last year's growth from that of the preceding are familiar points to find heavy infestation. The leaves and the fruit itself are occasionally infested."—Bulletin 18, Missouri State Fruit Exp. Sta.

REMEDIES.

In order to attack this pest in a rational manner it is necessary to note the following points:

(1) The Oyster-shell Bark Louse belongs to the class of sucking insects and subsists only on the sap of the plants which it infests and secures this food only by thrusting its beak through the skin or bark.

(2) This being the case it is plain to be seen that arsenical poisons as used for foliage or bark-eating insects will be of no avail.

(3) Sucking insects are most expeditiously destroyed by coating their bodies with some oily or caustic spray.

(4) Soapy or oily sprays have been exclusively used until recently, applying at the time the young lice appear. (See extract from Missouri Bulletin for best season.) These are still standard and efficient remedies and should be used in all cases of bad infestation in addition to the dormant spray advised below.

Kerosene emulsion is cheap and wholly practical as the materials are always at hand or readily available. (See formula p. 8.) Spray thoroughly at season when young lice are active. This period of activity is limited to less than two weeks followed by the building of a scale or "armor" by each insect under which it may remain secure from attack until the time when the Lime-Sulphur can again be safely used. It is therefore necessary to watch closely, following the blossoming period, for the appearance of the young lice and to spray promptly with the kerosene emulsion.

(5) The Oyster-shell Bark Louse has heretofore been considered almost invulnerable during the egg-laying and dormant period on account of its shell or "armor" which could not be penetrated or dissolved by any spray that would not also injure the bark.

It has been shown, however, by recent experiments, that the lime-sulphur wash used so successfully in destroying the San Jose scale, is efficient when used against the Oyster-shell Louse.

The lime-sulphur should not be used on growing plants owing to its caustic properties. For the Bark Louse it may be applied at any time during the fall, winter or early spring before growth starts. (A formula for preparation is given on p. 9.)

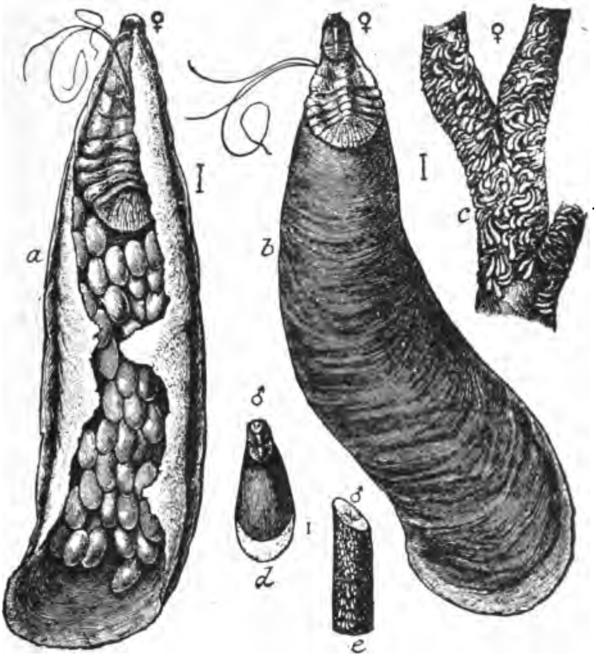

Fig. 2. Oyster-shell scale (Lepidosaphes ulmi L.): a, Female scale from below showing eggs; b, same from above, greatly enlarged; c, female scales; d, male scale, enlarged; e, scale on twig, natural size. (After Dr. L. O. Howard, Year Book U. S. Dept. Agr., 1894.)

SPRAYING MACHINERY.

The application of spray mixtures necessitates the use of some sort of force pump. Spray pumps and machinery may be divided as follows on the basis of efficiency:

(1) Syringes, atomizers and other like devices known as "hand" sprayers, used to spray house plants and small plants in the garden.

(2) Pumps or devices adapted for small gardens where a few currant bushes, small trees, etc., are grown.

(3) Pumps for general orchard and field work and the spraying of shade trees under fifty feet in height.

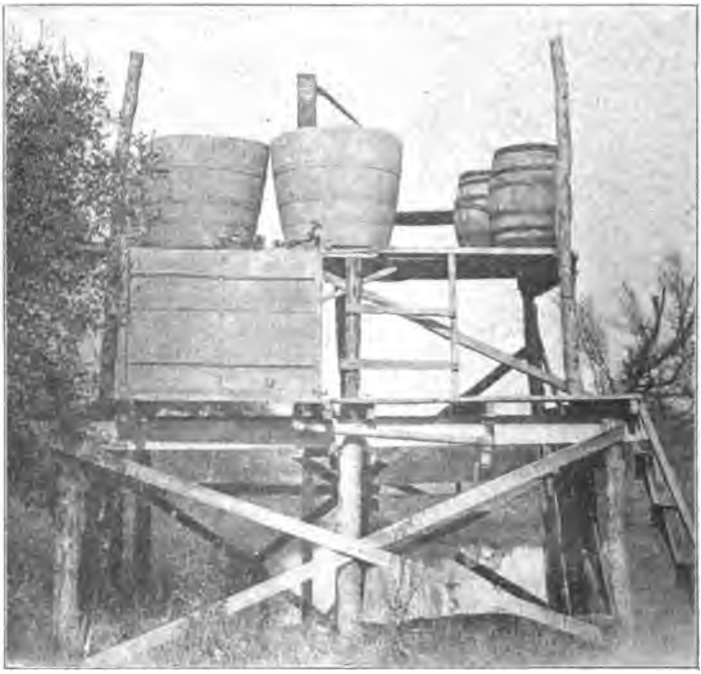

Fig. 3. "Spray mixing outfit of good design. Note the following features: Barrels for concentrated lime and copper sulphate solutions, tubs for dilute mixtures, and vat for mixing; also pump at rear to draw water from spray pond. This outfit lacks elevated supply tank and storage shed." Illustration and legend from Circular 120 Illinois Agr. Exp. Sta.

(4) Large pumps operated by gasoline or other power and adapted to any class of work, but designed especially for extensive orchard and park work.

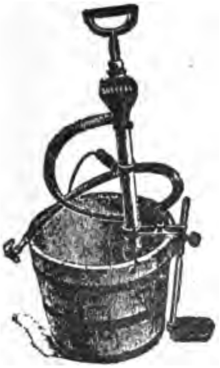

Fig. 4. Bucket spray pump.

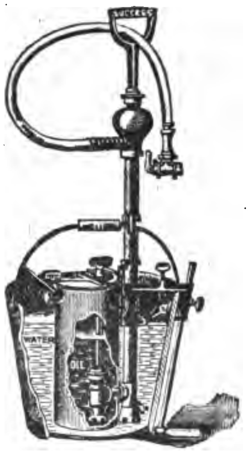

Fig. 5. Bucket pump with kerosene attachment. The "Success" pumps figured here are made by the Deming Co., Salem, Ohio.

The average Wisconsin farmer or orchardist will seek for a pump in either the third or fourth class.

In addition to these many machines adapted to special lines of work are offered for sale, as potato sprayers, etc.

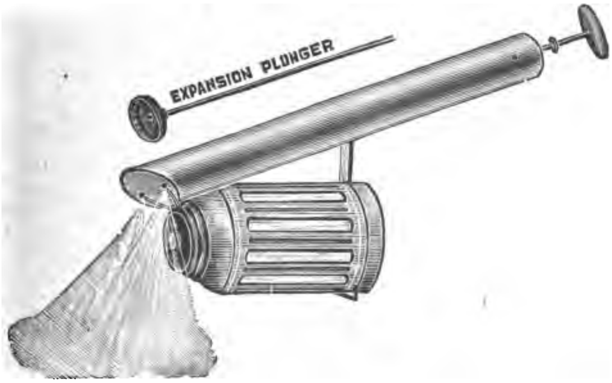

Fig. 6. Hand sprayer, valuable principally in the flower garden.

(1) The cheapest and simplest of efficient pumps may be found in the first class, viz., "hand" sprayers or atomizers. These sell for $1.00 to $2.00 and some are very efficient little sprayers.

Their usefulness, however, is confined to a very narrow field on account of the limited capacity for fluids and the very short distance sprays can be thrown.

(2) In this class are bucket and knapsack pumps and of these the bucket pump is to be preferred. Trees 10 to 15 feet in height may be sprayed with a bucket pump, also bushes, vines, etc. On some kinds a kerosene attachment is provided (Fig. 5), by means of which a mechanical mixture of kerosene and water may be applied to destroy sucking insects. Where but a few young trees, bushes, etc., are to be sprayed a bucket pump will answer all purposes, but for orchard work the time employed in refilling the bucket and in transporting the pump and mixture will more than offset the increased cost of a larger pump.

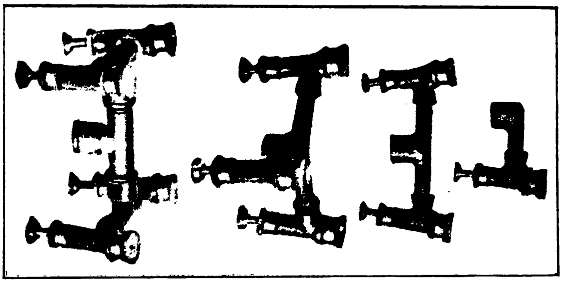

Fig. 7. Clusters of Vermorel nozzles.

(3) In this class are the various barrel pumps. These are operated by hand and designed to be fitted to an ordinary barrel (Fig. 12). This is the most popular kind of pump and it is probable that more of these are used in Wisconsin than any other kind. While primarily designed to be used in a barrel, these may be fitted to a tank or other receptacle.

With pumps as with other machinery, the best is usually the cheapest in the end. Do not expect to get a serviceable pump for a low price. The best pumps have all working parts, valves, plungers and cylinder, of brass. A pump that retails for three or four dollars may be of some service in washing windows or carriages, but is of slight value in spraying.

Nozzles.

No matter how efficient the pump, good work cannot be accomplished without good nozzles. Many kinds are offered for sale, but of the multitude of forms but two types are in common use. These are represented by "Bordeaux" and "Vermorel."

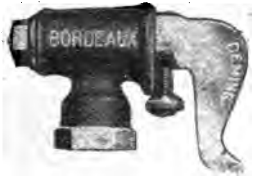

Fig. 8. Bordeaux nozzle.

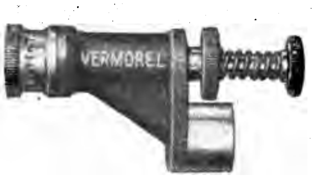

Fig. 9. Vermorel nozzle.

In the former the spray is formed by the fluid being forced against metal obstructions after it leaves the nozzle proper; in the latter a rotary motion is given it within the nozzle, breaking the fluid into extremely fine particles before it leaves the nozzle.

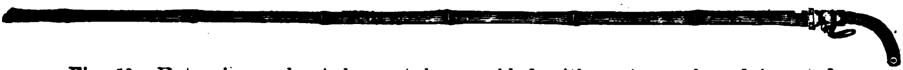

Fig. 10. Extension rod. A brass tube provided with a stop-cock and inserted within a bamboo pole.

The "Bordeaux" is adapted for use where the spray must be thrown several feet and in windy weather, but it cannot be graduated to produce as fine a spray as the "Vermorel" and is not, therefore, as economical of material as the latter. As nozzles are not a large item of expense in a spraying outfit it is well to have both kinds at hand.

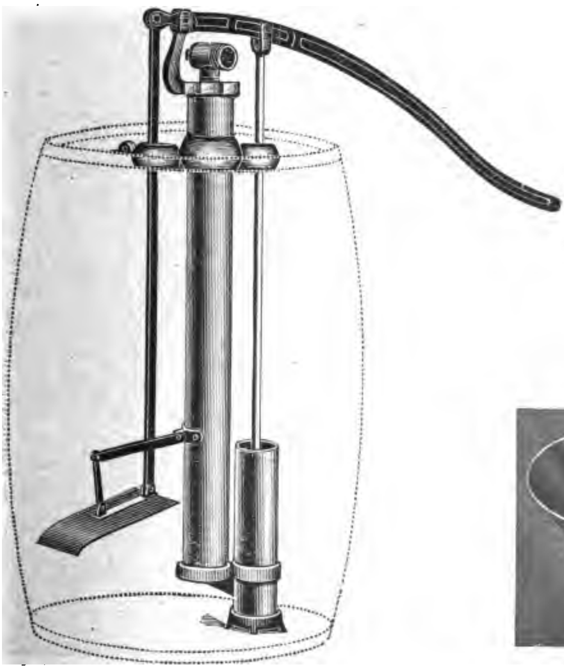

Fig. 12. A good hand pump for orchard work; may be used either in a barrel or tank.

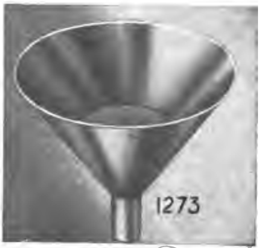

Fig. 11. Strainer.

Extension rods.—In spraying large trees these are almost a necessity, as by means of a rod (Fig. 10) the spray may be directed to the inside of the tree, which could not be reached without it except with great loss of material.

A gallon measure made of copper is convenient but not necessary.

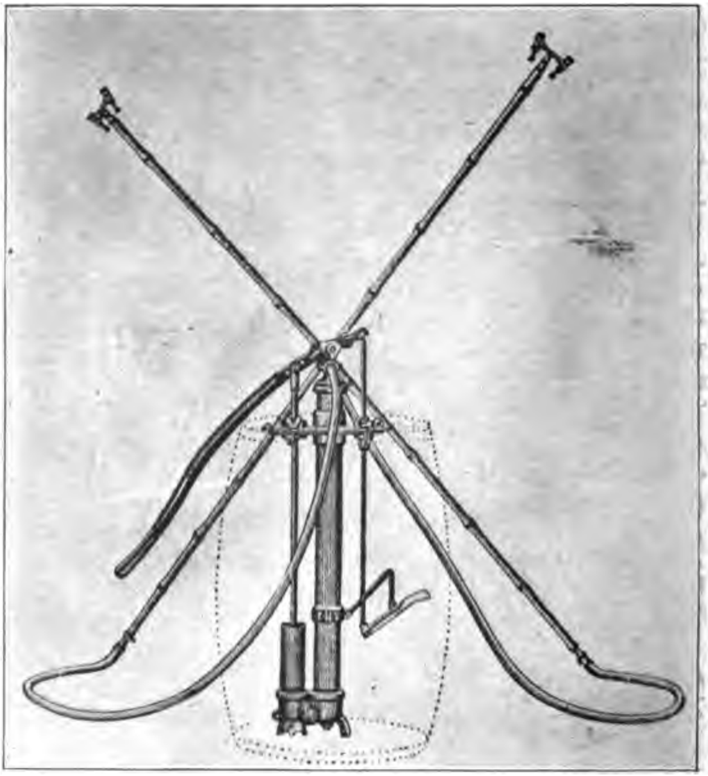

Fig. 13. An efficient pump equipped with two leads of hose, extension rods and Vermorel nozzles.

A strainer of some sort is always needed to remove coarse particles of lime, etc. Burlap should never be used for straining on account of the loose fibers or thread which pass into the strained mixture.

A large copper funnel with a wire gauze strainer is better than burlap. Hose, nozzles, strainers, rods, etc., may be purchased of firms furnishing spray pumps.

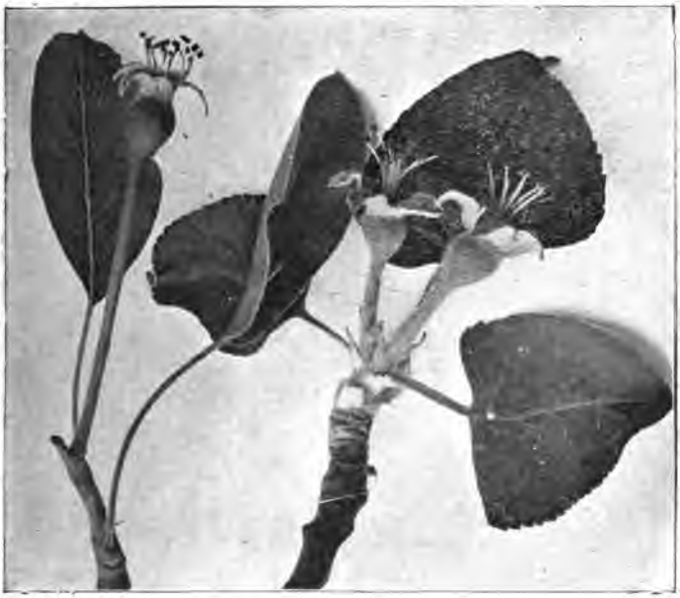

Fig. 14. "Just right to spray. A pear and two apples from which the petals have recently fallen. Note that the calyx lobes are widely spread." Illustration and legend copied from Bull. 142 Cornell Univ., N. Y. M. V. Slingerland, author.

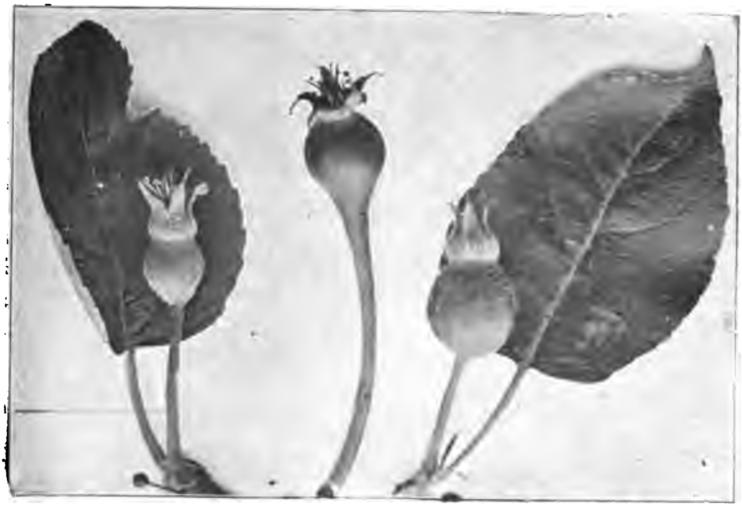

Fig. 15. "Almost too late to spray apples effectively. Note that the calyx lobes are drawn nearly together, while on the pear in the center, the calyx-cavity is open." Illustration and legend as above.

SPRAY:

WHAT?	WHY?	HOW?	WHEN?			REMARKS
			1ST SPRAYING	2D SPRAYING	3D SPRAYING	
Apple	Scab	Bordeaux Mixture	Just before Blossoms Open	Just after Blossoms Drop	10 days after 2d Spraying.	
	Codling Moth	Arsenate of Lead combined with Bordeaux	Just after Blossoms Drop	10 days later	Last week of July or 1st week of August for 2d brood	1st and 2d Spraying same as 2d and 3d for scab; merely add arsenate of lead to Bordeaux
	Oyster Shell Scale	Lime-Sulphur	March or early April but before growth starts			Do not use Lime-sulphur on growing plants
Cherry and Plum	Mildew and Shot-hole fungus	Bordeaux Mixture 3—4—50	When leaves are about ½ grown	10 to 12 days later	10 to 12 days later	
Currant and Gooseberry.	Mildew, blight and Currant worm	Bordeaux and Arsenate of Lead	When leaves are fully developed	2 to 3 weeks later		
Grapes	Mildew and Anthracnose	Bordeaux	Before leaf buds open	2 to 3 weeks later	3rd, 4th and 5th applications at intervals of 2 week, if required	
Strawberry	Leaf-spot or blight and leaf eating insects	Bordeaux and Arsenate of Lead	When first leaves appear	After blossoms fall		
Raspberry and Blackberry	Anthracnose and fungous diseases	Bordeaux	As above	2 weeks later		Spray new growth after fruit harvest

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